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varying quantities to the problem of railroad management. It shows, as will be observed from the margin, the price of gold, expenses, renewal of ties, renewal of iron, earnings, number of miles of road maintained, tons of freight carried, number of passengers carried, and the mileage of engines. Of course in a diagram of this kind many other data could be represented,

The proportion which the receipts of a railroad bear to the expenses, and the relations of the latter to each other, are of course the final subject of consideration by the managers. Up to the present time we believe the world has not yet been favored with a board of directors,

or other owners of a railroad, who have indicated any disposition to manage their property for any ultimate purpose whatsoever excepting that of making money. To do that, in a business so complicated as "railroading" necessarily is, requires that the managers should know not only what the income and expenditures are but also the manner in which they influence each other. Few men are blessed with memories so quick and retentive, and at the same time with a sufficient amount of a certain kind of imaginative power, as to be able to realize from a table of statistics the relative proportion of some half dozen varying elements in any problem. The difficulty of making even simple calculations in mathematics mentally or of playing any game, as chess for example, is an illustration of how much the mind is aided by the eye in comprehending the relations of several different and varying elements.

It is, of course, not a new invention to represent graphically the changes which take place in any phenomena, whether it be a record of meteorology, as of a thermometer, of social statistics, as of marriages or deaths, or of financial matters.

Diagram of Business,

We publish the diagram above, because it is an ingenious adaptation of this means of representing

start from the 12th horizontal line where it crosses the vertical one which represents 1858. From 1853 to 1854 the earnings amounted to \$1,800,000, consequently, we draw the line intended to represent the earnings from the 12th vertical division in 1853, to the 18th vertical line in 1854. From 1854 to 1855 they amounted to nearly \$2,400,000—therefore the line is extended from the

point in 1854, where we stopped, upward to the 24th line in 1855. From 1856 to 1857 the earnings decreased so the line descends from above the 26th division to the 25th. In this way each of the lines is drawn according to the scale given.

It will be noticed that there is a certain degree of parallelism in nearly all the lines. The effect of the depression of 1856 on the amount of freight and number of passengers carried is curious and marked. From 1856 to 1857 there was a very marked falling off of the tonnage of freight, while passenger travel nearly held its own. From 1857, however, the latter commenced to fall suddenly down to 1860, when it again commenced to rise until 1861, when the depression of the war again carried it downward. In 1862 it commenced to rise, and continued to do so rapidly until 1866, the close of the war, when it fell almost as rapidly. In 1869 the road was consolidated into the Lake Shore Line, and since then the accounts are not kept separate from the other portions of the line. The diagram is an interesting subject for study, and doubtless the managers

other roads would

gain much valuable information and have some new ideas suggested, by plotting in a similar way, the statistics of their own roads.

To those of our readers who are not engineers we will say, that ordinary cross-section paper—which can be bought of any dealer in drawing materials—has the requisite vertical and horizontal ruling similar to that above.

—The incorporators of the Chippewa Valley & Lake Superior Railroad Company met at Eau Claire, Wisconsin, and elected as officers: H. C. Putnam, of Eau Claire, President; H. Clay Williams, Secretary; L. C. Stanley, Treasurer.

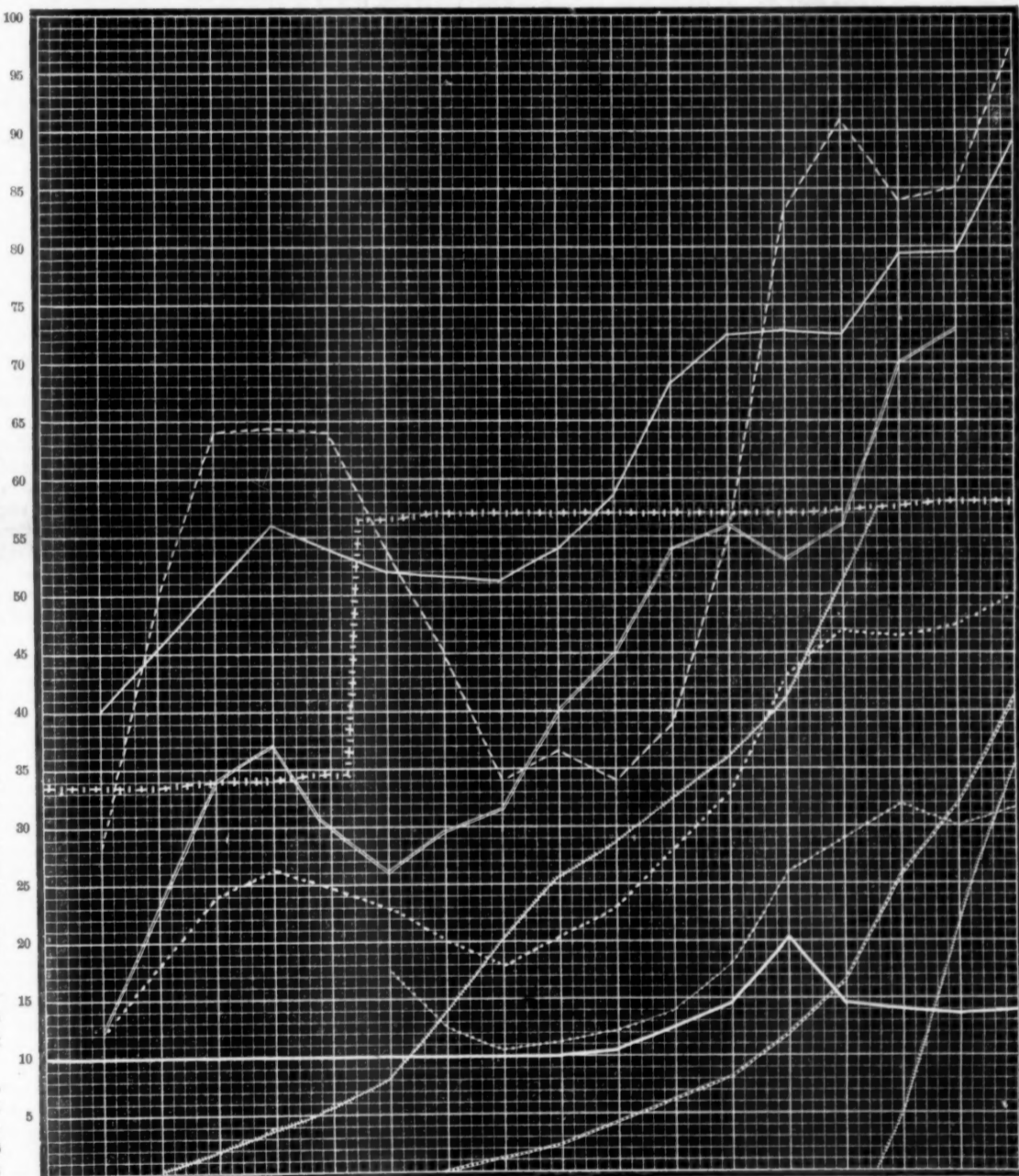


Diagram of Business, Expenses and Renewals on the Michigan Southern & Northern Indiana Railroad.

especially if the scale was larger, so that the lines would not be liable to interfere with each other.

The figures at the bottom of the diagram are the years and those at the side number the vertical divisions. The lines representing different groups of statistics are drawn to different scales, as indicated in the table of scales; those statistics which are related to each other being plotted to the same scale, so that their relations to each other may be compared. Take for example the line representing the earnings, which is plotted to a scale of \$10,000 to each vertical division: From 1852—the time when the road was opened—to 1853 the earnings amounted to \$1,200,000. We therefore

Scales.		
Mileage of engines each vertical division.....		20,000 miles.
Passengers carried.....		10,000 passengers.
Tons of freight carried.....		10,000 tons.
Road maintained.....		10 miles.
Renewal of ties.....		10 miles.
Renewal of iron.....		10 miles.
Earnings.....		\$100,000
Expenses.....		\$100,000
Average price of gold.....		10 cents.

Contributions.

THE BRAKE QUESTION.

It is a favorable indication of progress in railroad practice that at the present moment no little amount of thought is being given to the subject of brakes. It would seem certainly according to common sense that the foremost man in the train—the engineer—should have himself the power to stop or check its momentum in the shortest possible time and distance.

Inventions have been made for this purpose by the legion, but their adoption has been to a great extent quite limited. Railroad men either have felt but little interest in the subject or they have been satisfied to run the chances, contenting themselves with such precautions as are necessary to keep the track clear, and depending only on the brakemen, hoping of course that each accident would be the last. Hundreds of accidents have occurred within a few years past wherein it has been perfectly evident that if the train could have been stopped quicker, little or no damages would have occurred. The coroner's inquests in these cases seem to have been satisfied with merely an ordinary examination, and seldom has the question been asked, "Could the train have been stopped quicker?" But the age of progress has not passed. It is not every officer that neglects his duty, and perhaps the coming man will be one who adopts every precaution that common sense and practical experience suggests. Human life and limbs are valuable, and it will not do to sacrifice them too freely as the courts demonstrate.

Railroad officials themselves are not sufficiently careful to see that their own instructions are carried out. They are too apt to wink at or overlook little neglects where no bad consequences follow. This is a mistake. No neglect, however trifling, should pass unnoticed. This precaution alone would promote safety to a great extent.

Brakes as an element of safety are of the highest importance. It is undeniable that the destructive effects of railroad accidents are the direct result of the vast momentum inseparably connected with the movement of great bodies of matter at high speeds. Hence it follows that the more perfect and effective the devices for arresting the momentum and the quicker they can be brought into action, the greater will be the safety. The saving of a single second of time in the application of the brakes will often be just the difference between safety and disaster. The safety brake adopted by the Hudson River Railroad some years ago has been by far the most successful of any invention before or since for the purpose of making the action of the brakes simultaneous, prompt and decisive. A brief description of them will suffice, as some thousands of them are already in use. Attached to the brakeman's windlass is a drum containing a strong spiral spring, equivalent to the power of the brakeman. Just before or immediately after the train starts the brakemen wind up the springs tight. The clutches holding each spring in check are then connected to the bell cord leading to the engine. At the instant of danger whether first known by the engineer or at any point on the train, every brake is applied by the pulling of the bell cord.

The theory of this invention is, that for all ordinary purposes the application of the brakes by properly trained men is sufficient.

The safety brake is used only for those sudden emergencies that arise in spite of every precaution, and with this safety attachment, or automatic brakeman, the brakes are available at any point in an instant, or in cases of derailment or breaking apart of the train, the brakes are applied by the straining of the cord in separating. This is an immensely strong point in this invention, as has been demonstrated repeatedly.

It is sometimes said that as this invention is intended only as a safeguard it is not likely to be in use when the emergency arises. This idea, however true in theory, is not in fact in the present case, as the whole apparatus is so closely connected with the ordinary brakes and bell cord that the brakemen must know whether it be in order or not.

At the present time, also, there is much talk in railroad circles about the air brake used on the Pennsylvania Railroad. The object of this invention is to dispense with the brakemen and to require the engineer to work the brakes entirely from the engine.

This is an old and taking idea with railroad men, and every invention ever made to give the engineer control of the brakes has been intended to dispense with the brakemen. The air brake consists of a cylinder placed under each car with its piston connecting with the brake levers. On the engine or tender is a reservoir of compressed air which is conveyed to each

cylinder by pipes with flexible connections between the cars. The whole arrangement is controlled exclusively by the engineer, who applies and releases the brakes by simply turning a cock. This arrangement is the most perfect of any yet devised for this purpose and is in fact the only practicable plan by which all the brakes can be acted on from the engine with uniformity. The chain brake that was very popular on the Pennsylvania Railroad a few years ago has now ceased to exist anywhere. It was adopted by a large number of roads and for a time was popular, but it was found not to apply the brakes with uniformity. The chain was liable to brake and the brakemen were found to be necessary to the train for other purposes than braking. The air brake is destined to be a success, if the cost in the first instance and the cost of maintenance does not prove a serious obstacle. It certainly will require due and careful attention. There must be no leaky pistons or leaky connections, or it will fail disastrously, for a failure in any part is fatal to the whole for the time being.

For that class of accidents where the obstacle is seen by the engineer in time to apply the brakes, it will be admirable and equal if not superior to the Hudson River safety brake. It will be a great convenience to the engineer, as with a little practice he will be able to handle his train with the utmost precision.

There need however be no fear that the success of the air brake will displace the safety brake. It will, on the contrary, tend to make its value as an independent safeguard only the more apparent. In all that class of accidents that arises from breaking of rails, wheels, axles, parts of engines, sudden derailment, etc., etc., there is not nor can there be any element of safety equal to a brake that works on every car perfectly independent of every other.

Let us hope that the agitation of this subject and of every new invention for the purpose will serve to draw the attention of railroad men to this all important subject. To attain the highest degree of safety the true plan would be to adopt both of these improvements. If that cannot be afforded, then adopt one or the other. A proper regard for the safety of life and limb will not justify neglect in this matter, as the value of the best breaking appliances with the ordinary hand brakes has been demonstrated again and again.

MR. FAIRLIE ON DEAD WEIGHT AGAIN.

No. 9 VICTORIA CHAMBERS, WESTMINSTER, LONDON, S. W.

TO THE EDITOR OF THE RAILROAD GAZETTE:

Since posting my letter of the 3d of December to you, I have been furnished with a copy of the report and balance sheet of the Milwaukee & St. Paul Railway Company for the year ending 1867, and on examination I find the average number of passengers carried by each train for each mile run, amounts to seventy-two, and the average number of tons of merchandise in each train for each mile run, to seventy American tons, or 140,000 lbs.

The composition of the passengers and merchandise trains I cannot find in the report. I am therefore driven to use the figures given in your article on "The Gauge for the Railways of the Future," to obtain this information.

The average composition of the passenger trains, quoting from your article, is:

Four 60-seat passenger cars weigh.....	152,000 lbs.
One baggage car.....	25,000 "
One locomotive and tender.....	100,000 "
	277,000 lbs.

Deduct the baggage car, it not being necessary for passengers.....

	252,000 lbs.
And we find.....	252,000 lbs.

representing the weight of an average train for passengers only.

Suppose we now take this number of seventy-two passengers, the average number carried per mile, by the above train, and multiply it by the 140 lbs.—the average weight you assign in your article to each passenger—we shall get a passenger weight of 10,080 lbs., which, compared with the 252,000 lbs. employed to carry it, gives a proportion of 25 of dead weight to 1 of paying load. This proportion, or rather disproportion, of 25 to 1, it appears to me, is not very far removed from the condition of things at home here, where it is 29 to 1, as stated in the paper to which you have taken so much exception.

Let us now see how the proportion between the merchandise and trains turns out when examined in the same manner:

Again quoting from your article, you give the average composition of merchandise trains to be:

25 cars which weigh.....	500,000 lbs.
1 engine and tender.....	105,000 "
	605,000 lbs.

In this case also you employ an average train of 605,000 lbs. weight to carry 140,000 lbs. of freight, show-

ing the proportion of dead to paying weight to be 4.32 to 1, as compared with our 7 to 1. These results the working of the Milwaukee line prove most conclusively how very much you were out in your calculations, and that when I said you did not thoroughly understand the subject, it was because I could see by the manner you handled it that you had not looked at the matter in the light I now show it to you. Had you done so, I felt convinced, as I stated in my letter, that you would on no account have written as you have done, and that a careful inquiry would have set you right; but, whilst I felt this, I was not prepared to find the proportions in the two countries would run so near alike as they do. I was prepared to find your dead weight to be about half what it is with us, from the nature and composition of your mode of working, which would really be nearly the case were it not that the dead weight of your passenger stock to seating capacity is about double what it is in Europe.

I am informed by those who have seen the Michigan Southern & Northern Indiana Railroad Company's report for the year ending March, 1868, that the proportion of dead to passenger weight carried on this line is even greater than that on the Milwaukee & St. Paul.

I am, sir, your obedient servant,

ROBT. F. FAIRLIE.

Independent Feed Pumps for Locomotive Boilers.

TO THE EDITOR OF THE RAILROAD GAZETTE:

In an editorial in your issue of December 10, you state that there are many objections to the use of the Giffard injector as a substitute for the ordinary pump, but you would recommend its use as an auxiliary. In this I think most if not all engineers will agree with you, although there are many master mechanics who persist in the dangerous practice of relying solely on two injectors, while others will not use the injectors, but prefer to take the chances with two pumps alone. Neither practice can be regarded as otherwise than dangerous. I have just read a newspaper account of a serious accident that occurred only a few days since, by which two lives were lost and several other persons dangerously injured, to say nothing of a large amount of property destroyed, all occasioned by the pumps becoming deranged.

The account states that the engineer of an express train stopped between two stations to *tinker the pumps*, when another train following too close ran into it. No doubt this accident, like hundreds of similar ones, would have been prevented by the use of an injector. Accidents arising from deranged pumps are of frequent occurrence, and the use of one pump and one injector can hardly be regarded as any more reliable than using two pumps, inasmuch as the injector is as likely to become deranged as the pump. Of course in case of "stalling" or any accident which would prevent pumping up, the injector is preferable, but its use should be mainly as an auxiliary, and no locomotive should be considered in good running condition unless it is supplied with two pumps and one injector, or what is preferable, an auxiliary steam pump. I have reference to a small rotary steam pump now rapidly coming into use as an independent feed pump, and which, I think, vastly superior to the injector in every respect. It is easily managed by any intelligent engineer, or a fireman may safely take charge of it when necessary. It will work at any pressure of steam that would effectually operate an injector; its first cost is less than that of the injector; it is simple, strong and durable, not liable to injury from the shocks and jars incident to locomotive practice, and therefore I think that no locomotive of the present day is "up with the times" unless equipped with two pumps and an auxiliary steam pump. At this season pumps frequently become disabled by the hose bursting, which is in most cases the result of frost and carelessness.

It is a false economy that saves a few dollars in feed water appliances. To run a locomotive for the purpose of pumping up costs money, and although this expense might not be sensibly felt by a rich company, it is one of those small leaks that help to swell the running expenses, and is an item worthy of consideration. The mileage made by locomotives in freight and construction service, etc., for pumping is considerable. Engineers running heavy trains are frequently obliged to leave their trains to pump when struggling up a heavy grade, even when the pumps are in good order, for reasons which are obvious. The delay caused by this operation often leads to serious trouble, which a few minutes' use of an auxiliary pump would have obviated. It is not unfrequent that a large gang of men employed on a construction train are obliged to wait for the engineer to pump up. Although this is sometimes owing to negligence on the part of the engineer, yet on many occasions it cannot be avoided by the exercise of any

amount of vigilance. In short, there is hardly a day but an auxiliary pump would be found of great convenience, to say nothing of the serious accidents that may be prevented by its use. I well recollect once asking a master mechanic what he thought of the Giffard injector. He remarked that he had never used but one, and the engine to which it was attached was demolished soon after, and the injector with it, and he was d—d glad of it. He regarded it as a nuisance. I have since, on many occasions, seen his engineers in trouble for the want of an injector, notwithstanding its objectionable features. The truth of the matter was, he had not fully become acquainted with the principle of its operation, and he placed it in charge of an engineer who was also ignorant of its workings and decidedly opposed to any "new-fangled machine," and could not or would not see any good in it.

And here lies the real cause of so many locomotives being unprovided with reliable feed-water apparatus. It requires patience and practice to fully understand the workings of some of these "new-fangled notions;" and it is the lack of these, together with a lack of interest in the matter, that causes much trouble to railroad men and expense to the owners. We have abundant proof of this in the fact that some roads are equipped with appliances that they could not be induced to part with, while other roads have given them a partial test and thrown them aside as worthless. It is well to give new improvements a fair trial before casting them aside, and any improvement in the line of feeding boilers is certainly worthy of serious consideration.

WM. S. H.

LOUISVILLE RAILROAD NEWS.

LOUISVILLE, Ky., Dec. 20, 1870.

TO THE EDITOR OF THE RAILROAD GAZETTE:

That railroad men, as a class, are far behind other trades and professions, in the general information necessary to success in their business, cannot be denied. This, in a great measure, can be traced to the meagre supply of railroad news heretofore published, most information being gained from men changing from one section of country to another, or by the uncertain and indefinite means of letters passing between employes of different lines of roads. The organization of the engineers' society, and the publication of their journal, has, in a measure, improved the means of inter-communication, but its limited space does not, and cannot, meet the necessities of the times. Your journal, if what it purports to be, should meet with a general and hearty support. Railroad men from a general lack of information of railroads in different sections of country, are often put to great inconvenience and expense in changing from one road to another, or when out of employment, in not knowing the state of business in different sections.

The roads in this section are just now all quite busy, the business has been improved by late connections. The Indianapolis road since the completion of the Ohio River bridge forms a connection on the south side of the river with the Louisville & Nashville road. The Louisville & Cincinnati Short Line is now about forming a connection with the Louisville & Nashville in the south part of the city, forming a direct line from Cincinnati to Nashville, Memphis, New Orleans and most important cities south. The Louisville & Nashville road is the great thoroughfare from this point south, and is doing an immense business. The amount of merchandise and machinery passing south is almost incredible. The traffic north is cotton, tobacco, cattle and hogs.

The general management of the road is under Albert Fink, Esq., assisted by D. C. Rowland, who is also Master of Transportation.

The machinery department is under the direct supervision of Thatcher Perkins, formerly of the Baltimore & Ohio Railroad, but more recently of the Pittsburgh Locomotive Works. He has inaugurated the system of building engines and cars and has designed and turned out several engines of superior style, and well adapted to the heavy trade of the road; also a large number of freight cars, and some superior passenger and sleeping cars designed to run from this point to New Orleans.

The company has built largely the past season and has erected a large amount of the most improved machinery for car and engine repairs and construction.

Houston & Great Northern.

Messrs. Mitchell, Henry & Shephard, contractors, announce that they have seventy-five miles of grading on this road to sub-let. The profile and specifications may be seen at their office in Houston, Texas, or information may be had from Mr. Wm. Shephard, at Jerseyville, Ill., or in Chicago at No. 210 South Water street, Room 8, or at No. 241 Randolph street, Room 1.

Perils of Bridge Building

The following is the testimony W. A. Roebling, Chief Engineer of the East River Suspension Bridge, respecting the late fire in the timbers of the caisson:

I have been, for a year and a half, Chief Engineer of the Bridge Company, and am in constant attendance, day and night, except time for sleep; I go into the caisson twice a day; I know a fire occurred in it on Thursday night; it broke out at 7½; we have had in all four fires; the foot of the caisson is composed of yellow pine timber laid at right angles, and bolted together vertically and laterally: the seams in the roof are caulked with oakum for a depth of four inches to make it air tight; the crevices above are filled with tar and cement; between the fourth and fifth is a sheet of heavy tin; to increase the tightness and to guard against fire, every seam is pointed with cement, so that if a candle should get there it would not draw in the fire; the only place not pointed with cement was where the fire broke out.

The lights are of three kinds—14 calcium lights, 36 gas burners, and candles for general illumination; all the men use candles; they are sunk in the ground usually, as we have gone down and increased our pressure we have discovered that the combustion of compressed air is more rapid; there has been so little experience with caissons that that fact has not generally been thoroughly known; from what I have been able to learn I believe an empty candle box was nailed against a frame in the roof, someone of the workmen either kept his clothes or his whisky bottle there; my idea is that that man looked into the box at three o'clock in the afternoon, and held a candle in one hand while reaching in with the other, and brought the flame into it; from the amount of damage done it must have taken that much time; the fire was not discovered until it had burned half a timber.

We first applied carbonic acid gas, but this proved ineffectual; they then put on two streams of water, one with an inch nozzle, and played until the fire was out; the only openings in the roof were two, four inches in diameter; the water run down in a steady stream till 10:20; when I came down into the caisson I ran a large bar through the holes; I directed a steam jet of one inch to be thrown on; the steam jet ran about an hour; we supposed the fire was out, as no trace of it was visible; the air drew the water up; this continued until 2 o'clock, and then the water commenced to drip, and so showed that the fire might be out; we looked up the holes, but saw no trace of fire; then it was about 5 o'clock; I felt I should be paralyzed if I stayed another minute; I was partially paralyzed, and am not quite over it now; I stayed seven or eight hours; I left word to let me know if a spark was seen; I was rubbed for three hours with whisky and salt.

At 8 o'clock a fire was discovered at the fourth or fifth course of timber, by the carpenter who had been boring in search of the fire; then we flooded the caisson; it requires 1,400,000 gallons of water to flood it; the operation of flooding a dry caisson is risky; the air pressure must be kept up to support the weight; this was done perfectly; the caisson settled two inches; I don't think the damage has passed beyond the tin barrier; if necessary, we will cut a hole in it, and a man can fill the crevice, and that hole will be filled with vertical posts, but this will not be done until the caisson is finished; 75 stone pillars are now building for the support of the caisson; there was no sign of defection or yielding in the roof when the last man came out of the caisson.

Mr. Young, one of the foremen, and several workmen, have become paralyzed from working in the caisson. The damage will not be more than \$400 or \$500. Yesterday the pumps were set to work, and the water forced out of the caisson.

Stability of Narrow Gauges.

Engineering, in the course of a discussion with Mr. Fairlie on the proper gauge for the new Indian railroads, has the following on the stability of trains on narrow gauges. Mr. Fairlie had recommended a 3 ft., and Engineering a 3 ft. 6 in. gauge:

In a vast empire like India, possessing many important centres of trade situated at great distances apart, of great native wealth, and being a possession regarded with envious eyes by other nations, it is highly essential that the railway system should be something more than a ready means of transporting products capable of being packed in bulk in wagons of almost any size or shape. It appears to us that such a country should possess a railway system capable—by the facilities which it affords—of promoting intercourse between different districts, of aiding in the introduction of machinery in places to which the difficulties of transport at present preclude its introduction; and last—but by no means least—capable of rendering important aid in a military sense, in the event of the country being disturbed by revolt or invasion. If the future duty of the railways of India was to consist merely in the transportation annually of a certain number of tons of native produce, we should be less disposed to urge strongly the advantages of the 3 ft. 6 in. as compared with a narrower gauge—although even in such a case, we believe, those advantages would be well worth all the extra money they would cost, and more—but we contend that the railways should be capable of doing more than this, and that they should especially be adapted for the convenient transport of troops, with their horses and artillery. Now, it appears to be generally conceded that the maximum width of vehicles which can be conveniently and safely worked in regular traffic on any railway is about double the width of gauge; and adopting this rule, we have 5 ft. 6 in. as the maximum width of the rolling stock for the 3 ft. 9 in. gauge, while on 3 ft. 6 in. lines a maximum width of 7 ft. would be admissible. These widths would correspond to widths of floor inside the wagons

of 5 ft. and 6 ft. 6 in. respectively, and in the conveyance of light goods, and especially of machinery and artillery, this extra 18 in. of width would possess great value. Again, if the question of stability is taken into consideration, we shall find that the extra 9 in. in the width of the gauge offers most important advantages. On the ordinary 4 ft. 8½ in. gauge, lines drawn from the inner edges of the rails to the centre gravity of a wagon carrying an average load enclose between them an angle of about 45°; and in determining the proportions of the rolling stock used on the Norwegian Railways, Mr. Carl Pihl very properly endeavored to obtain an angle of stability nearly approaching this. The angle which he did obtain is stated by him at 40½°, and the results of the practical working of his lines has shown that this angle is in all probability sufficiently large. If now we take an angle of stability of, say, 40°, and ascertain the height at which the centre of gravity of a wagon carrying an average load would have to be situated to give this angle in the case of a 3 ft. 9 in. gauge we find this height to be about 3 ft. 8½ in., while in the case of the 3 ft. 9 in. gauge it becomes 4 ft. 10 in. Next, if we take the height, above the rail of the wagon floor to be in the case of the 3 ft. 9 in. gauge, 2 ft. 3 in.; and in the case of the 3 ft. 6 in. gauge, 2 ft. 9 in. (advantage being taken of the increased width of gauge to use larger wheels), we shall have in the one case a space of 2 ft. 1 in. between the respective floor lines and levels of the centres of gravity. To favor the narrower gauge slightly, and at the same time, to get even dimensions, we will call these last mentioned distances 1½ ft. and 2 ft. respectively. Now it will be found that in the case of a wagon carrying bulky goods, such for instance as half-pressed cotton or even goods measuring, say, 70 cubic feet to the ton, the centre of gravity of the wagon and load may be taken with tolerable accuracy as being situated about one-third the height of the load above the floor line: and thus if the height of the centre of gravity above that line be fixed, we have only to multiply this distance by three to get approximately the limiting height of the load. Doing this in the instances we have been considering, we get heights of 4 ft. 6 in. and 6 ft. respectively; and multiplying these heights by the respective widths of floor, we get 4.5 × 5 = 22.5 square feet, and 6 × 6.5 = 39 square feet as the respective maximum transverse sectional areas of load, supposing the angle of stability to be kept the same in the two cases. In other words, with a certain angle of stability the carrying capacity per lineal foot of wagon would be about 1½ times as great on the 3 ft. 6 in. as on the 3 ft. 9 in. gauge, and this we think is certainly a most important arrangement in favor of the former where bulky goods have to be transported.

This, however, is not the only light in which the stability question is to be viewed. We have said that Indian railways should be capable of transporting horses, and this in itself opens up important considerations. Horse boxes are by no means pleasant things to deal with even on the 4 ft. 8½ in. gauge, and on the 3 ft. 9 in. gauge we scarcely see how they are to be satisfactorily dealt with at all. In saying this we do not refer to any difficulty in giving them the necessary capacity—that could no doubt be done—but in insuring the requisite stability an ordinary horse-box presents laterally about 85 square feet of surface, and if mounted on 2 ft. wheels, the centre of area of this surface would be about 6 ft. 6 in. above the rail level. Any wind pressure acting upon the side of the vehicle, may therefore be considered as applied at that point. Under the action of a side wind, the tendency of the vehicle would be to turn over on the lee rail as a fulcrum, and the weight of the vehicle and its contents would act to resist this tendency, as if applied at the end of a lever equal to half the width of the gauge. If we suppose a horse-box on the 3 ft. 9 in. gauge to carry two horses, its weight may probably be taken as four tons including its load: at all events, if dead weight is not to be increased by reducing the gauge, it should not be more than this. The righting moment tending to resist overturning will thus be 4 × 1.375 = 5.5 foot-tons; and the pressure of wind per square foot on the side of the vehicle capable of just balancing this force, will be but $\frac{4 \times 2,240 \times 1.375}{85 \times 6.5} = 22.3$ lb., a pressure far below that to

which such vehicles would under by no means exceptional circumstances be expected to be exposed. If the horse-box was empty or but partially loaded, its resistance to being blown over would be even less than this, and altogether its stability would be far below that which would be desirable.

We have now stated some of the considerations which have led us to advocate the 3 ft. 6 in. gauge in preference to the 3 ft. 9 in. gauge, but there are still others, possessing a certain amount of weight, and to these we intend to refer in a future article. We may remark here, however, that so long as the goods to be transported consist merely of such produce as could be stowed in wagons of any desired capacity, the trains might, by properly adjusting the bulk carried by each wagon, be run safely on either gauge at speeds up to, say, 25 or 30 miles per hour. And we further believe that, by the employment of the Fairlie engine, trains of any weight likely to be required in India for many years to come, might be drawn on even the narrower gauge. But, as we have shown, other matters than mere speed and weight have to be taken into consideration in determining the new Indian gauge, and it is these other matters which lead us to advocate the width of 3 ft. 6 in.—Engineering.

Leavenworth, Atchison & Northwestern.

The Council of Leavenworth has rescinded an ordinance granting right of way through that city to the Leavenworth, Atchison & Northwestern Railroad for non-compliance with its contract. This, it is said, will probably suspend the running of through train, from St. Louis to Atchison. The Missouri Pacific has been running three trains.

3. If the intermediate sleepers are made of fir, one or two sleepers—according to whether 15 or 21 ft. rails are used—ought to have two spikes on the outside of the rail base, or small bedplates 3 or 4 in. wide should be adopted, in order to increase the resisting power of the spikes against lateral pressure, and especially to bring the inside spike also into action. The number of these outside spikes or bedplates ought to be increased in curves of small radii on the outer line of rails; and for curves of 1,600 ft. radius and less, each sleeper ought to be doubly spiked on the outer line of rails or ought to be provided with a bedplate with two holes.

4. The impregnation of the sleepers with chloride of zinc does not influence the resisting power of the spikes, but this power seems to be a little less for newly prepared sleepers which are still completely saturated with water.

5. The belled spikes (Fig. d) possess the smallest resisting power, this power being only 0.7 or 0.9 of that for prismatic spikes of the same weight.

6. No favorable result is obtained by twisting the spikes or by jugging their edges.

7. The resisting power of double pyramidal spikes (Fig. c) of short length is for deal about $\frac{1}{4}$ greater than that of straight prismatic spikes (Fig. b) of the same weight; this advantage does not exist, however, in the case of spikes of greater length, nor when the spikes are driven into oak.

8. The simple pyramidal spikes (Figs. c and a), and the prismatic spikes (Fig. b), if both are driven equally deep into the wood, offer the same resisting power against being drawn out of the timber, whilst if the same volume of both is driven into the wood the holding power of the former is for oak and for long spikes about 1-10th, and for deal and for shorter spikes about $\frac{1}{4}$ greater than the resisting power of prismatic spikes. But with respect to the resisting power against lateral displacements within the limits important for permanent way structures, the prismatic spikes are in a similar proportion stronger than pyramidal spikes.

9. The pyramidal spikes, costing about 20 per cent. more than prismatic spikes of the same weight, the advantage of the smaller volume of iron driven into the wood for the necessary depth of 5 or 6 in. (found by experience to be a sufficient depth for the spiking of the rails), is completely compensated; the prismatic spikes are, therefore, preferable to pyramidal spikes, as the former, besides their greater resisting power against lateral pressure, have not the great disadvantage of the latter spikes of becoming, when once loosened, soon entirely powerless.

Baron von Weber's Experiments on the resisting Power of Spikes. The experiments above described being of a very satisfactory kind, Baron von Weber's researches were conducted so as to deal with questions to which Herr Funk's experiments did not relate, and they were especially carried out for the purpose of ascertaining the influence of the pressure of the wheels against the rails upon the resisting power of the spikes. The results obtained in these researches are not to be considered as answers to theoretical questions regarding the power of spikes to resist being drawn out of the timber by forces applied in the direction of their length or by displacement at right angles to their axes, but they form useful data directly applicable in the practice of railway engineering. The following is an account of Baron von Weber's researches:

23d Series of Experiments. These experiments were carried out as follows: Two rails were placed upon new and sound fir sleepers, and were at first spiked in the usual way, with four spikes, to one sleeper only. The spikes used in all these experiments were 14 millimetres (= 0.5518 in.) square, had chisel-shaped points, 30 millimetres (= 1.18 in.) long, and were driven 100 millimetres (= 5.5 in.) into the timber, the area of spike surface in contact with the wood being thus 73 square centimetres (= 11.3 square inches). The rail being fixed, the small hydraulic press already referred to was arranged as shown in Figs. 21 and 22, so that it acted against the heads of the rails, and thus tended to cant the latter, and draw the spikes out of the sleeper.

When the press exerted a pressure of 10 centners (= 1,134 lb.) the gauge of the rails was widened 10 millimetres (0.39 in.) without any alteration being observed in the fastenings, but an increase in the pressure to 15 centners (1,701 lb.) gave rise to a noise resembling that produced by drawing firmly-fixed nails from sound timber, the widening of the gauge being increased to 13 millimetres (0.51 in.) and one of the inside spikes being lifted 5 millimetres (= 0.27). A pressure of 16 centners (= 1,814 lb.) supplied to cant the rail completely, and draw the spike just mentioned. The hole from which the spike had been drawn was then filled up, and the spike again driven, when it was found, on the press being applied, that a pressure of 17 centners was required to widen the gauge 13 millimetres, the opposite spike to that which had previously been drawn being thus lifted. The resisting power of the first spike had thus been increased above 20 per cent. by being redriven into a filled-up hole; but although, as Baron von Weber remarks, this does not agree with Von Kaven's results, yet it may be explained by supposing that, owing to the presence of the filling, the spike, when redriven, caused a greater compression of the fibres of the timber in its neighborhood than it did when first inserted.

24th Series of Experiments. These trials were made in the same manner as the last, but the fir sleeper was replaced by one of oak. The rails were secured by new spikes, and the results were as follows:

Pressure applied. centners, lb.	Widening of gauge. mil. in.
10 = 1,134	6.0 = 0.236
20 = 2,269	7.5 = 0.296
30 = 3,403	9.0 = 0.354

At the last-named pressure one of the inside spikes yielded with a loud crack, and a continued pressure of 20 centners only was required to complete the canting of the rail. After the spike had been drawn about 30 millimetres, it was pressed away from the rail, and left the base of the latter free.

25th Series of Experiments. In these trials the same rails were fastened down to two fir sleepers, and the press was placed so as to act on the heads of the rails midway between these sleepers. A pressure of 20 centners (= 2,269 lb.) produced a widening of the gauge of 13 mil., without, however, loosening the spikes; while with a pressure of 45 centners—the gauge being then widened 25 millimetres—two inside spikes, diagonally opposite each other, yielded, and a third followed immediately afterwards. With a continued pressure of 50 centners (= 5,672 lb.) one of the rails was canted, and the spikes completely drawn.

26th Series of Experiments. These trials were made in the same manner as the last, the two sleepers, however, being of oak in place of fir. The results are subjoined:

Pressure applied. centners, lb.	Widening of gauge. mil. in.
10 = 1,134	3.0 = 0.118
20 = 2,269	4.5 = 0.177
30 = 3,403	7.5 = 0.296
40 = 4,537	10.5 = 0.413
50 = 5,672	13.0 = 0.512
60 = 6,806	33.5 = 0.925

With this latter pressure one spike became loose, another had its head bent, without being loosened in the timber; and the outside spikes were displaced in the sleeper about 10 mil. = 0.39 in.

27th Series of Experiments. In this case the rail was fastened to three fir sleepers, and the press was placed directly over the central sleeper. The results were as follows:

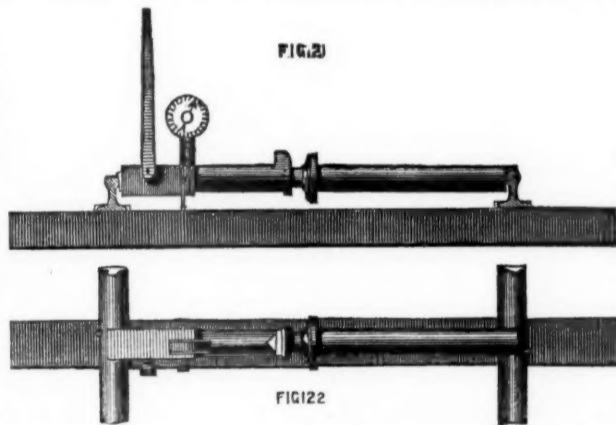
Pressure applied. centners, lb.	Widening of gauge. mil. in.
20 = 2,269	6.0 = 0.236
25 = 2,836	10.0 = 0.394

With the latter pressure one of the spikes on the central sleeper became loose, and with a pressure of 40 cwt. the same effect was produced on one of the spikes on an outer sleeper; while a pressure of 60 centners (= 6,806 lb.) produced canting of the rail, all the spikes being loosened.

28th Series of Experiments. These trials were conducted in the same manner as the last, oak sleepers being, however, substituted for fir. The following are the results:

Pressure applied. centners, lb.	Widening of gauge. mil. in.
10 = 1,134	2.5 = 0.099
20 = 2,269	4.5 = 0.177
30 = 3,403	6.0 = 0.236
40 = 4,537	7.5 = 0.296
50 = 5,672	10.5 = 0.413
60 = 6,806	14.5 = 0.570
70 = 7,940	16.0 = 0.639
75 = 8,507	19.0 = 0.748
80 = 9,075	24.0 = 0.945
85 = 9,642	28.0 = 1.102

With the maximum pressure one of the inside spikes was drawn, and the heads of two others were bent without the spikes themselves being loosened in the timber. The horizontal displacement of each spike was almost uniformly 4.5 mil.; and when the pressure was removed the rails showed a permanent



lateral displacement of this amount, the spikes being all more or less disfigured.

29th Series of Experiments. In this series the rails were fastened down to four sleepers, and the press was placed so as to act against the heads of the rails midway between the central sleepers. Baron von Weber does not state of what wood the sleepers used in this set of experiments were made; but judging from the results, which are subjoined, they must have been of fir.

Pressure applied. centners, lb.	Widening of gauge. mil. in.
15 = 1,701	4.0 = 0.157
25 = 2,836	9.0 = 0.354
35 = 3,970	13.0 = 0.512
45 = 5,105	19.0 = 0.748
55 = 6,239	25.0 = 0.984
65 = 7,373	36.0 = 1.417

With a pressure of 45 centners the four spikes nearest the press became loose, and with the pressure of 65 centners the bottom flange of one of the rails got clear of the heads of its spikes, and the rail was canted. Until the widening of the gauge amounted to 13 mil., the rails returned to their normal position on the removal of the pressure.

When a pressure of 65 centners had widened the gauge 36 mil., as recorded above, the rails were taken up and straightened, and the holes in the sleepers being filled up, the rails were put down again and fastened with new spikes. The press was then again applied with the following results:

Pressure applied. centners, lb.	Widening of gauge. mil. in.
15 = 1,701	6.0 = 0.236
40 = 4,537	19.0 = 0.748
55 = 6,239	one rail canted.

Although these experiments with re-spiked rails show no important diminution in the holding power of the fastenings, it is considered by Baron von Weber that this may only be the case with new sleepers, and in cases where the old holes were filled with particular care.

The average results deduced by Baron von Weber from the experiments we have recorded, are that in the case of the fir sleepers, a force of about 1,850 lb., and in the case of the oak sleepers, a force of about 3,000 lb. was required for drawing the spikes. As the latter had 73 square centimetres, or 11.3 square inches, of surface in contact with the timber, the forces required for drawing the spikes were:

	Pounds per square centimetre of surface.	Pounds per square inch of surface.
In fir sleepers.....	25.3	163.2
In oak sleepers.....	41.8	269.6

These values for the holding power are much less than those found by Von Kaven and Funk, and there is also somewhat less difference between the respective holding powers in fir and oak than was shown by the researches of those experimenters. Baron von Weber, however, considers—and we agree with him—that the difference between Von Kaven and Funk's results and his own are fully accounted for by the fact that in the latter experiments the spikes were not merely subjected to a pull in the direction of their axes, but were exposed also to lateral pressure, the pull being exerted on the under side of the nose or head. Baron von Weber considers also that from the fibres of oak having less flexibility than those of fir, this lateral pressure would produce greater loosening of the spikes in the former than in the latter timber, and hence there would be less difference in the holding power of the spikes in the two kinds of sleepers, than was shown by the researches of former experimenters who applied a direct pull to the spikes.

This fact shows, as is remarked by Baron von Weber, that results of direct practical value can only be obtained by experiments carried out under the circumstances which exist in actual practice, and he considers for this reason that the values for the holding power of spikes deduced from his researches are more reliable for practical use than those obtained from previous experiments.—*Engineering.*

[TO BE CONTINUED.]

Locomotive Improvement.

In our last impression* we endeavored to show that no improvement in the comparative efficiency of the locomotive boiler can be expected so long as the existing type is retained in its integrity. This argument is based on the fact that the modern boiler, being no better than the boiler of ten, fifteen, or twenty years ago, it is hopeless to expect any further improvement. It is, of course, just possible that the able engineers who have devoted their attention to designing locomotives have one and all suffered those features in which improvement could have been effected to escape them; but this theory is to the last degree improbable. We hold, therefore, to our statement that unless some radical change is introduced in the construction or working of locomotive boilers, we are not justified in reckoning on any better result than an average evaporation of some six and three-quarters or seven pounds of water per pound of coal burned. What the radical change in construction and working is to be we are unable to say positively, but we can at least indicate the nature of the alterations which are likely to prove advantageous; and it is to be borne in mind that, although these alterations may be very radical and thorough in their character, it does not necessarily follow that the general characteristics of the boiler, at least as regards external form, need undergo much change.

In former articles we have explained the points in which the ordinary portable engine boiler constructed by agricultural engineers is superior to the vertical boiler, but the statements we have made with regard to portable boilers will not hold good for the locomotive boiler. We have deprecated to a certain extent any innovation on ordinary portable boiler practice, but we cannot deprecate innovation on ordinary locomotive practice. The principal causes of the low economical efficiency of the locomotive boiler are inefficiency of surface, want of circulation, and rapidity of draught. The tubes in locomotives are packed so close that the presence of good circulation is almost out of the question; but the tubes in portable boilers are so widely spaced that the circulation ought to be, and doubtless is, much more efficient. As regards the second point the draught is much less in portable than in locomotive engines; and for any given length of flue the products of combustion are suffered to remain a longer time in contact with the iron. Lastly, the temperature of the water in portables being much lower than in locomotives, an element of economy is secured in the first which is lacking in the latter. We shall not extend our comparison between two boilers so apparently similar in type, but totally dissimilar in working conditions. It will, we think, be found, on close examination of every point connected with the two boilers, that the similarity between them is apparent only; and that it is simply impossible to argue from the results obtained with one, what results ought to be obtained with the other. We may, therefore, dismiss the portable boiler for the present. We have spoken of it here only to guard ourselves against the possibility of being accused of inconsistency by those who think proper to read these

* Page 296 of the RAILROAD GAZETTE.

articles with those which appeared in our impressions for July 29th and August 5th, 1870.

Before we can hope to improve upon the existing locomotive boiler, it is absolutely essential that we should thoroughly comprehend the nature of the defects which it is proposed to eliminate. What these are we have just stated in general terms. But many people speak of the phenomena of defective circulation, inefficient surface, and forced draught, without possessing any accurate perception of the way in which these defects really operate for evil. We shall endeavor to place these matters in the clearest possible light, and to draw some conclusions which, at the same time that they are, as we believe, unavoidable, will not fail to suggest a means of improving the evaporative economical efficiency of the locomotive boiler.

First, as regards inefficiency of surface. This simply means that the tubes and fire-box plate, become coated with scale, which, being composed of sulphate of lime and other salts, and earthy matters, is a very bad conductor of heat. The effect of the presence of this deposit on the tubes and fire-box is that less heat can escape in a given time from the products of combustion into the water than would be the case if the deposit were not present. In effect, deposit virtually reduces the length of the tubes and diminishes the size of the fire-box. It is not certain, however, that deposit in moderate quantity diminishes the actual efficiency of a steam boiler. Peclet has shown that iron boilers evaporate just as much as copper boilers in a given time, although the conductivity of copper is nearly double that of iron, because, to use Peclet's own words, "When the thickness of a metal is augmented, its conductivity is diminished, but the temperature of its external surface is augmented in just the same proportion." "It is believed that, as the quantity of heat transmitted augments with the temperature of the exterior surface, the influence of the kind and thickness of the metal is very trifling." Peclet then goes on to furnish proofs in support of this belief, for which we must refer our readers to Peclet's "*Traité de la Chaleur*," tome premier. Again, it must not be forgotten that the quantity of heat passed in a given time through a plate depends much, very much, more on its power of absorption and emission than on its power of conducting. The precise meaning of this statement will be found very clearly set forth in a paper on "Water-tube Boilers" read before the Society of Engineers on the 6th of May, 1867, and reproduced shortly afterwards in our pages.

Now we do know that deposit directly affects the conducting power of a tube, but we do not know whether deposit increases or diminishes its emissive power. It is possible that a coated surface will emit more heat than a plain smooth metal surface, because the coat of deposit is rough, and the roughness may aid the formation of steam like the coil of silver wire on the little bits of pure coke used by chemists to obtain equable ebullition in laboratory experiments. But whether it does or does not, it is certain that the direct effect of anything more than the thinnest possible coating of deposit operates prejudicially. It does not follow that the actual energy of a boiler as a steam generator will fall off. The temperature in the tubes is augmented and the same quantity of heat finds its way per second or per minute into the boiler, but this result is only obtained by harder firing; in other words, by burning more coal. The dirtier the tubes and fire-box the higher will be the temperature in the smoke-box, and of course the greater the waste.

And here it will be well to notice an objection constantly urged by those who believe in the excellence of the locomotive boiler which may be thus stated:—"The boiler can only be uneconomical by wasting heat, but if it wastes heat, that heat will be found in the smoke-box; it will manifest its presence in the high temperature of the escaping gases. But there is not a high temperature in the smoke-box, therefore heat is not wasted." This is a very logical proposition, which breaks down only at the end. No one knows accurately what the temperature is in the smoke-box. So long as an engine is not heavily taxed and the draught is moderate, it is indisputable that the temperature, especially if the tubes be long and small, is low; and there can be no question that engines moderately loaded and running at low speed evaporate more water per pound of coal, provided combustion be perfect, than does an express engine careering across the country at fifty miles an hour with ten or a dozen heavy carriages behind it. The boiler quickly falls off in efficiency as the quantity of coal burned increases, and this is no doubt one reason why the cost of transport increases so rapidly in proportion to the speed, albeit it is one which has not received half the attention it deserves. But to return to facts connected with smoke-box temperature: Stephenson's experiments made in the neighborhood of Derby, in 1843, showed that in the ordinary locomotives then in use the temperature in the smoke-box was great enough to drive zinc off in vapor; and this metal requires a temperature of not less than 800 deg. to melt it. As a result of these experiments, Stephenson introduced his well-known "long boiler" locomotives, many of which are still running on the Great Eastern and other railways, with tubes nearly 14 ft. long. The evidence usually adduced in opposition to the idea that a high temperature exists in the smoke-box, is based on the fact that the black paint put on outside lasts a long time; but this is not good evidence, because, first, the inside of the box is always lined with a thick coat of soot, which is an admirable non-conductor; and, in the second place, the smoke-box plates are exposed to the action of a violent current of air, which increases in its effect with the speed of the engine. Besides this, there is little doubt but that the products of combustion operated upon by a powerful draught rush direct from the tubes to the chimney, and are, therefore, drawn away from the sides and front of the smoke-box, which is always some inches larger than the barrel of the boiler. The wonder is, considering the cooling effect of the external air,

that the paint is ever burned off a smoke-box at all. But it is none the less likely that the temperature within frequently reaches, or perhaps exceeds, 800 deg., or at least 450 deg. more than the water within the boiler. As the draught is dependent on the exhaust, and not on the temperature of the escaping gases, as in stationary boilers, there is no reason why the temperature in the smoke-box should exceed that in the boiler. The only method of even approximately obtaining that result as yet used by engineers consists in lengthening the tubes; but this plan is always attended with the disadvantage of rendering a smaller blast pipe—and consequently an increased back pressure—necessary to maintain the draught. It remains to be seen whether other remedies may prove more effectual.

It is to be regretted that no accurate experiments have been made to furnish us with data as to the precise loss of efficiency due to the gradual accumulation of deposit on locomotive heating surfaces, but enough is known to prove conclusively that a great point would be gained if it were possible so to construct the boiler that either no deposit could form, or that the boiler could be taken to pieces and thoroughly cleansed, say, once a year. Our readers will, we think, admit unanimously that the presence of either one or both of these conditions in any boiler proposed as a substitute for the ordinary locomotive boiler would be a strong point in its favor. We may have something more to say about this further on; just now we must turn to the consideration of the second defect in the existing boiler—want of circulation. About the rapidity of escapes of the products of combustion little more need be said than we have stated already. It is impossible to reduce it without augmenting calorimeter, which cannot be done under existing arrangements. Whether it can be done at all with success, or whether it is necessary it should be done, are points the consideration of which we shall reserve for the moment. As regards the question of circulation in locomotive boilers, it is difficult to speak without using as an illustration of our meaning an explanation of what appears to us to be the only available method of making it really efficient, and this deserves an article to itself. However, we may say something which will lead up to the article to which we refer.

Most engineers admit freely enough that the circulation in locomotives is not what it ought to be. Yet in practice we find them cramming their boilers as full as they will hold with tubes. Half inch spaces are by no means uncommon, and some French engineers have stowed their tubes but 44 of an inch asunder. We have heard it argued, and by good authorities, too, that the reason why locomotives so made are not economical and burn their tubes, is that there is not water enough in contact with each tube—in other words, that the thickness of one-quarter of an inch of water is not enough to take up all the heat passed by the tube. No greater mistake could be made. The true objection to the close stowing of tubes lies in the fact that the steam as it is formed on the tube surface cannot get away, and as a result it is steam, not water, that is in contact with the metal. Water is an excessively bad conductor of heat, but is perhaps the most powerful absorber of heat known when properly used. The close stowing of the tubes would matter nothing if only we could get rid of the steam, but this we cannot do so long as we dispose tubes in such a way that the area of escape is contracted and interrupted to the least degree, while no sufficient means are provided for sweeping the bubbles of steam off the tubes. A strict analogy exists between the boilers and condensers, and it may be taken as proved that *within certain limits* the quantity of steam which can be condensed by a given surface is altogether independent of that surface, and absolutely dependent on the quantity of cold water brought in contact with it in a given time. In the case of boilers much the same truth holds good. If we take a thin metal pipe and pass it through the fiercest furnace which it is possible to get, that tube cannot be over-heated, provided enough water is sent through it in any given time. Extension of heating surface is neither more nor less than a substitute for defective circulation and absorption. To put this more plainly; if we have two plates of metal, each exposed on one side to the same temperature, and each in contact with a given quantity of water on the other side, than by doubling the quantity of water brought into contact with one we may practically double the efficiency of that surface as compared with the other. It is to be borne in mind that if the original quantity of water in contact with each plate is great enough to absorb all the heat it can have, then of course our proposition will not hold good; but this is not the case with locomotive boilers. The tubes there are in very much the condition of a sauce pan on a fierce fire with but a spoonful of water in it, not sufficient evenly to cover the whole bottom. If this spoonful be kept constantly renewed as evaporation goes on, still the saucepan bottom will not generate as much steam or do as much work as would another saucepan on which a jet of water continually impinged. The film of water might be of the same thickness in both cases, but in the latter all the steam bubbles would be swept away, while in the former they would continually intervene to prevent true contact between the metal and the water. It is not the deficiency of water, but the presence of steam between and in contact with the tubes that impairs the efficiency of the locomotive boilers with close stowed tubes. If only we could dispose of the steam, we might put our tubes an eighth of an inch asunder, provided we could provide means of clearing the tubes of deposit. It is simply impossible, however, to get rid of the steam as fast as it is formed in locomotives with close-packed tubes. How, then, is the objection to be got over? The answer is this, and it embodies so important a proposition that we put it in italics:—*Do not allow any steam to be formed between the tubes; and we shall put this in more general terms by stating that every boiler, locomotive or other, in which it is intended that the heating surface shall possess a maximum efficiency, must confine its functions to the heating of water, not to the*

direct production of steam. Under no circumstances should steam be directly produced by any heating surface, unless means are provided for removing that steam immediately. We propose to show, in a third article, how it is possible in practice to apply principles the soundness of which was recognized in an indistinct and misty kind of way many years ago.—*The Engineer.*

Austrian Railroads in 1869.

From the official returns published in the *Austria*, of Vienna, the eighteen railroads in the Western or German half of the Empire had, at the end of last year, 911 German (or about 4,500 English) miles of road open for public traffic, and their gross receipts for 1869 amounted to 115,667,199 florins, showing an increase of 4,478,014fl., as compared with the previous year. The largest receipts were those of the Austrian State Railway Company, with 32,197,374fl. (against 31,374,444fl. in 1868), the Southern with 30,479,255fl. (against 27,990,464fl. in 1868), and the Northern with 25,121,580fl. (against 24,385,346fl. in 1868). Ten railways have a surplus revenue of 6,251,235fl., five show a falling off of 1,773,251fl., and three, which were opened in the course of last year, produced 1,126,257fl. The surplus revenue of the ten companies is 6 per cent. more than in 1868, and the falling off of the five equals 13 per cent. less than their receipts in 1868, so that the total net increase is about 4 per cent. The lines that were opened in 1869 are the Moravian and the Silesian Northern (11.8 German miles), opened August 29, the Bohemian Northern (19 G. m.), opened January 16, and the Kaschau & Oderberg (4 G. m.), opened February 1. The longest of the railways are, 1, the Southern (Lombardy), 260 German miles; 2, the State Railway Company, 174½ G. m.; 3, the Austrian Northern, 82½ G. m.; 4, the Empress Elizabeth's Railway, 74½ G. m.; 5, the Galician, 61½ G. m.; 6, the Lemberg & Czernowitz, with extension to Jassy, 47 G. m.; 7, the Crown Prince Rudolph's Railway, 45 G. m.; 8, the Francis Joseph's Railway, 35½ G. m.; 9, the Southern & North German Junction, 30½ G. m.; and 10, the Bohemian Western, 27 G. m. In addition to the three new lines opened in 1869, as above stated, of the aggregate length of 34 German miles, 63½ G. m. were opened by other companies, of which 17½ G. m. by the Francis Joseph's Railway Company, 18 G. m. on the Crown Prince Rudolph's Railway, 14 G. m. on the Galician Railway, 12 G. m. the extension of the Lemberg & Czernowitz line to Jassy, and 2 G. m. on the Buschtierader Railway; making a total of 97½ German (nearly 500 English) miles opened in 1869.

Till the year 1866 the average cost of constructing railroads in Austria was rather less than 800,000fl. currency per German mile, including the loss on the price of emission and commission paid for obtaining the requisite funds. Since then, however, the expense has been less on only four of the new railways—viz., the Bohemian Northern, the Buschtierader, the Dux & Comotau section of the Aussig & Teplitz Railway, and lastly, the Alföld & Fiume line. All the others cost considerably more than the sum indicated above, and the most favorably constructed one is the Crown Prince Rudolph's Railway, which, however, cost 50,000fl. silver, or more than a million currency, and the section from Laybach to Tarois—on account of the exceptional difficulties to be overcome in that mountainous region, and the consequent frequency of the requisite tunnels, viaducts and bridges—as much as 1,195,000fl. silver per German mile. The Transylvanian line cost 920,000fl. silver, the Francis Joseph's Railway 950,000fl. silver, and the Kaschau & Oderberg 1,160,000fl. silver. The price for the Austrian Northwestern Railway was guaranteed not to exceed 984,000fl., but the contractors undertook to construct it for 690,000fl., as the engineering difficulties were found to have been much overrated and the estimates made proportionably higher; the traced line, when it came to be examined, was ascertained to be generally very favorable for a railway. With the exception of the Bohemian Northern, the Aussig & Teplitz, and the Buschtierader, all the above-mentioned new lines are guaranteed by the State to pay the shareholders a certain fixed percentage, which gives them an increased value and stability in the eyes of investing capitalists.

—In the United States Supreme Court, at Washington, on Monday, the following decision was rendered:

"No. 8.—Gray vs. Chicago, Iowa & Galena Railroad Company.—Appeal from the Circuit Court for the District of Iowa.

"This suit was brought to restrain the erection of a bridge over the Mississippi River at Clinton, Iowa, on the allegation that it would obstruct navigation and become a nuisance. Pending the suit, Congress passed an act declaring the bridge to be a legal structure, and making it a post route of the United States. On the trial, it was held that this action of Congress had concluded the case by legalizing the bridge, which had been declared upon as a nuisance, and the decree was accordingly affirmed here, the Court holding that the act of Congress gave the rule of its decision in the case at the hearing. Upon the same principle, the act in the Wheeling bridge case stayed the execution of the decree directing its abatement. Mr. Justice Nelson delivered the opinion."

—Col. Hulbert, one of the ablest railroad men of the South, who has had charge of the State railroads and lately has had charge of the construction of the Brunswick & Albany Railroad, has been chosen President of the Columbus & Albany Railroad Company.

General Railroad News.

MECHANICS AND ENGINEERING.

Construction of Fairlie Engines.

The firm of Sharp, Stewart & Co., Manchester, England, is constructing twenty-one Fairlie locomotives. Twelve of these are for a broad-gauge Russian railroad, five for a new narrow-gauge Russian road, and four for a Swedish railroad. The engines for the narrow-gauge Russian road are in some respects peculiar. They have four 18x18 cylinders, and each bogie has three pairs of coupled 3 ft. 3 in. wheels. The water is carried in tanks by the side of the boilers and under the foot-plate. The wood (which is the fuel to be used) will be carried above the barrels of the boilers. The engines weigh about 30 tons empty, and 40 to 42 tons with wood and water.

The Kellogg Bridge Company.

This new Buffalo bridge company has recently closed a contract for four spans of iron railroad bridge for the Wellsburg & Lawrenceville Railroad, of Pennsylvania, to be completed early in the spring.

The Breaking of Axles.

Mr. H. S. Harland, of Brompton, York, England, writes as follows to the *London Engineering*:

"As several railway wagon axles have broken of late, and as the consequences in some cases are so serious, I feel constrained to make a few suggestions through the medium of your valuable paper as to their cause and remedy. I believe the breakages are due in a great measure to the prevailing custom of 'scotching' the wheels when shunting, which must of necessity strain the axle, and produce a torsion of the fibres of the iron of which the axle is composed. No doubt the amount of torsion produced each time a wagon is scotched separately is immeasurably small, though cumulative; but when the scotching of one or two wagons is made to serve as a brake to the momentum of several others, heavily laden perhaps, the effect of the sudden strain upon the axles acted upon must of necessity tend to weaken them considerably; and when an already weakened axle has to bear the brunt of such a strain it may readily be perceived that a partial disintegration of the fibres will take place, which the vibration of a subsequent journey may complete.

"The evil alluded to might be lessened to a considerable extent by shunting and scotching each wagon separately, but such a system would incur a considerable loss of time, and hence I would suggest that each wagon be fitted with an improved and handy brake, and so do away with the necessity of 'scotching' altogether.

"We occasionally read of a locomotive tank axle breaking, but such is of very rare occurrence, on account of the brake being applied gradually. A crank axle broke the other day on a branch line noted for its steep gradient. The engines which do the work on that line, however, rarely leave it, and hence the brake axles are subjected to an undue amount of strain, and should in consequence be made of larger diameter, of extra tough iron (duly tested), and only allowed to be in use for a limited number of years."

The New Mining Locomotives.

The Baldwin Locomotive Works have had on exhibition for the last three days two mining locomotives, ordered for the Wilkesbarre Coal and Iron Company's collieries in the third anthracite coal region. Mr. Parrish wishes to find some substitute for the mule as a carrier in the mine. During a strike or other suspension of work, a large stud of mules is a great expense. A locomotive costs nothing when it is doing nothing, and if well cared for does not grow old. Another outlay is saved in the item of drivers. One man suffices to drive a locomotive; and a few couplers to handle an entire train. The fire box is square and deep, and so little stoking is required, that the fire door need not be opened more than four or five times during the entire day. While the locomotive was standing on the track in the shop, the steam gauge indicated 120 pounds pressure in the boiler, and yet the engineer had laid a damper plate over the chimney hole. Had the chimney remained open, the safety valve would have deafened the shop. It seemed difficult to explain this excellent draft; but it was an evident fact. The machine was run across the floor at various speeds, started with ease, and stopped in the space of a foot or two. There was an appearance of perfect docility about it, which relieved us from all suspicion of accidents underground.

On examining the working gear this little locomotive appeared to be as staunchly built and well finished as any passenger engine, but was entirely without ornament. The two cylinders, 9 inches in diameter (inside) by 12 inches stroke, lie under the front end of the boiler. The piston rods play between groups of our square solid rods, and a simply adjusted link motion

works just forward of the fire box. The connections are of course inside, on the cranked axle of one of the two pairs of drivers (of 30 inches), which are the only wheels. The fire box and low platform overhangs behind. As coal is always at hand, no coal space is needed, and the water-tank is folded over the top and sides of the boiler, acting as a jacket, and feeling quite hot to the hand.

This tank holds 190 gallons, and the whole engine, with fuel and water, weighs nearly 15,000 pounds. The makers guarantee that it shall haul, under all circumstances, with wet and dirty rails, on a level, 340 gross tons; on a 60 foot gradient, 80 gross tons; and on a 100 foot gradient, 50 gross tons. Under favorable circumstances it will of course do more.

The fire-box platform is covered with a light wagon-top roof to guard the engineer's head. The extreme height is 5 feet 4 inches; extreme width, 5 feet 1 inch.

Several engines, somewhat similar to these, have been constructed in Pittsburgh, and used in the mines of that neighborhood, giving satisfaction. These are somewhat simplified; but not to such an extent as to interfere with their being taken readily to pieces, examined, or repaired. It is needless to say that they are made with conscientious care, and made strong, to bear rough usage at the hands of ignorant or thoughtless persons. — *United States Railroad and Mining Register*.

East River Bridge.

In the *New York Tribune* it is stated that the Brooklyn caisson was, on the 22d inst., in its position. It says: "The caisson is now at a depth of 45 feet below low water mark, making the timber 4 feet lower than the bed of the river. The structure, weighing 30,000 tons, is supported by 74 stone piers, topped with brick work. These have been erected at proper intervals in the chambers of the structure, and are each four feet square, and built to within two feet of the roof of the chamber. The caisson has been sunk at the rate of from fifteen to eighteen inches each week since the time it was first placed at the bottom of the river.

"The filling in of the cavity beneath the caisson with concrete was begun last week. A wall of concrete will be laid around the base of the structure from twelve to fourteen feet in thickness, from the top to the bottom of the cavity, to prevent leakage that might by any possibility occur from beneath the outer or bottom edge. After this has been accomplished, the compressed air will be allowed to escape, and the interior will then be the same as any underground vault. To prevent the accumulation of impure air, a current of fresh air will be constantly forced through the chambers. Seven thousand cubic yards of concrete will be required to fill the chambers and different flues or shafts connecting them, which work will be completed by March next. The caisson will then be one solid mass, ready for the stone-work upon which will rest the immense cables required to sustain the roadway of the bridge."

OLD AND NEW ROADS.

Utica, Clinton & Binghamton.

An agreement has been entered into for leasing this road to the New York & Oswego Midland Company. By its terms the stockholders are assured six per cent. on the cost of the road, and that the road shall be completed as a steam road to Utica, so as to connect with the New York Central at or near the depot, and this condition must be carried out before the contract goes into full operation.

Walkill Valley.

Twenty-three miles of this road were last week completed, from Montgomery to New Paltz, in Ulster County. From this point to Rosendale, a distance of six miles, the road is under contract, and will be completed by the 1st of January. It is expected that the remaining link, seven and a half miles long, to Kingston, will be laid early in the spring. The company obtained a charter from the last Legislature for the construction of the road all the way to Albany, on the west bank of the Hudson, making the line eighty-five miles in length.

St. Louis & Southeastern.

The Shawneetown (Ill.) *Mercury*, of Dec. 22, says: "The St. Louis & Southeastern Railroad Company has built fifteen miles of road in this county since June last, and has, under the same direction, cleared the right of way in Hamilton county through the Scatters, so as to enable the work to proceed during the next year unimpeded by the waters that lie on those grounds until late in the spring. It has also got out a large number of ties in Hamilton county, between McLeansboro and Equality, and is now letting tie and clearing contracts along the entire line, to be completed this winter, preparatory to the grading, which will be prosecuted whenever the weather will permit. The whole line from St. Louis to Shawneetown is 140 miles long,

and will be finished within the year 1871, at a cost of about \$3,000,000. The last rail on the Springfield & Illinois Southeastern road was laid last Thursday. At half-past 12 o'clock, the iron connecting Shawneetown with the network of railroads in Illinois was nailed fast, and at about 3 o'clock a through construction train 'came rattling into town.'"

Burlington, Cedar Rapids & Minnesota.

The gap in the line, between West Branch and Cedar Rapids, is being rapidly closed up, and probably within the next two weeks cars will be running over the entire line, from Burlington to Cedar Falls, 163 miles. Arrangements have been made and the contracts let for an extension of the road northwest from Cedar Falls.

Sodus Point & Southern.

Mr. C. A. Canfield, Chief Engineer of the company says in his report: "The contractors commenced work on our road the 20th of September last. We have, at this time, fourteen miles graded, and shall have our road ready for the iron by the first of July next, and completed by the first of November. The completion of our line will connect Lake Ontario, by unbroken rail, with Washington, D. C.

Ohio & Michigan.

At a recent meeting held in Battle Creek, Mich., Gen. Parkhurst, of Coldwater, said "that at no time 'had those having the management of the road in 'their hands been idle, but had been continually endeavoring to promote its interest; that arrangements 'had been perfected for the ironing of the track; 'that the rolling stock would be secured through the 'influence of the Pennsylvania Central, that road proposing to work with and back up the Ohio & Michigan, and that the right of way had been secured for 'over 50 miles. He stated that at one place, known as 'the hog's back, in Gull Prairie, it had been found 'upon survey that it would cost \$75,000 just to grade 'three miles, thus making it necessary to raise \$62,000 'more, and that of this sum \$20,000 had been assessed 'upon Gull Prairie, \$21,000 to Battle Creek and \$21,000 'to Coldwater; that sufficient money had been raised 'to grade the track, but that in this peculiar case it 'would require \$62,000 more to be raised, which must 'be done immediately; that for this purpose this 'meeting has been called." A committee is endeavoring to raise the amount wanted, and it is believed that it will be obtained without much difficulty.

Evansville, Henderson & Nashville.

This road has been for some time in operation from Henderson, Kentucky, to Madisonville, 39 miles, and also from Hopkinsville, 36 miles to Guthrie, near the southern State line of Kentucky. Now we learn that the gap of 35 miles between Madisonville and Hopkinsville is very nearly completed and it is expected that through trains will be running by the first of February next.

Des Moines Valley.

This railroad was completed to Fort Dodge on the 23d inst. while the thermometer was 12 degrees below zero. Work on the extension from Fort Dodge northward will be commenced early next spring, and the line is to be completed to the Minnesota lines by the end of the season. The part of the road completed this season is but about 12 miles long.

St. Louis, Council Bluffs & Omaha.

A correspondent writes as from Gallatin, Mo., that this road, which has its southern terminus at Brunswick, on the North Missouri Railroad 185½ miles from St. Louis and is to extend thence in a northwesterly direction through Chillicothe and Gallatin, Mo., to Council Bluffs, Iowa, connecting the Union Pacific and St. Louis by a short line, is making haste slowly. The track has been laid for most of the distance between Brunswick and Chillicothe for some time and it was reported months ago that this entire section and also that between Chillicothe and Gallatin was completed. But our correspondent informs us that the track was only completed to a point two miles south of Chillicothe two weeks ago, and has crept on very slowly since. He says, however, that work on the first 40 miles, the part of the line between Chillicothe and Council Bluffs, is going on. On the first 20 miles the grading is finished and the bridging is in progress. On the next 20 grading is progressing. So far the work is under contract; but it is said that the road is to be completed to Council Bluffs during the year 1871.

Albia, Knoxville & Des Moines.

Hon. J. B. Grinnell has the contract for the construction of this railroad, eleven miles of which, to a fine coal mine, is about completed.

Boston & Albany.

A meeting of company stockholders was called to meet in Boston on the 15th inst. to consider the consolidation of the Albany & West Stockbridge Railroad Company and the Hudson & Boston Railroad corpora-

tion with the Boston & Albany Railroad Company. There not being a sufficient number of the stockholders present no action was taken.

North Grey Railway.

A bill has been introduced into the Ontario Legislature for the incorporation of the North Grey Railway Company, to construct a road from Collingwood to Meaford, in the county of Grey, a distance of twenty-two miles. The capital is \$150,000 in shares of \$100 each. Directors may be elected as soon as one-fourth of the stock has been subscribed, and twenty per cent. paid thereon. The gauge is to be five feet six inches—same as the Northern—and power is asked to lease the road to the Northern Company. The railway must be commenced in one year, and finished within two years of granting of charter.

Lexington, Lake & Gulf.

This company, which intends to construct a railroad from Lexington, Mo., southward, according to the Lexington Register "has a large force of men and materials now on the line of the road and is prepared to prosecute rapidly the construction. The work to be done embraces everything ready for the ties and iron. The distance between the two points on said line, and of work to be done, is about fifty-four miles, and unless there comes some unforeseen obstacle in the way of the company, we expect to see trains running from the Missouri River to Butler by midsummer. The work will begin at several points along the line at once, and if the winter should prove fair will not be suspended for a single moment. The contract time is the first of July next, but the entire work is expected to be completed at a much earlier day." Butler is the county seat of Bates county, and is about 70 miles south by west from Lexington, and 35 miles northeast of Fort Scott.

Union Pacific.

There has been a radical change in the divisions of this road for operating. Hereafter there will be but two divisions, the Eastern, from Omaha to Cheyenne, 516 miles, and the Western, from Cheyenne to the junction with the Central Pacific near Ogden, also 516 miles. The headquarters of the Western Division are at Evanston, where there are coal mines, where extensive shops are going up.

Missouri, Kansas & Texas.

The company have their line to the Arkansas river nearly graded. Southward they have three companies of engineers—one running toward Fort Smith, and two surveying and locating in Texas. It is the expectation to run trains to the Red River by January, 1871. The Texas surveying party had reached, when last heard from, Bear Creek, in Ellis county, about 100 miles south of the State line.

Madison & Portage.

The company has secured iron enough to complete the track to a connection with the Baraboo Air Line north of Madison, by which it will enter the city. It is to be completed immediately, so that trains may commence running.

Chicago & Southwestern.

On Thursday of the present week the iron was laid to a point three miles west of Drakeville, Davis county, Iowa, 21 miles from the crossing of the Des Moines river. The stations, as far as established, beyond the crossing of the river at Ashland are: Floris, 7 miles; crossing of the North Missouri Railroad, (7 miles north of Bloomfield) 7 miles; Drakeville, 4 miles; Unionville, 12 miles; Centerville, 13 miles; Bellaire, 7 miles. The road crosses the Iowa State line near the southwest corner of Wayne county, and the grading and bridging is completed to Trenton, Grundy county, Missouri, 44 miles from Cameron. Between Princeton and Trenton the line will follow the grade of the Chillicothe & Des Moines City Company, whose charter now belongs to the Southwestern Company. From Leavenworth northwest to Cameron the road is completed, leaving but 44 miles of grading to be done, between Cameron and Gallatin. It is expected to have the iron laid southward as far as Centerville during the next month. Enough iron is now at hand to complete the road to within 100 miles of Cameron, and, if no delay occurs in the arrival of the balance, it is probable that the road will be opened through to Leavenworth by August next.

Boston, Hartford & Erie.

The Massachusetts Supreme Court has authorized the receivers of this company to make the contract for the completion of the road to Willimantic Conn., on the ground that such an extension would save the property from depreciation, and render it more productive to all parties to the suit.

Sabula, Ackley & Dakota.

The Maquoketa (Iowa) Sentinel learns that the work of grading on this road has been entirely suspended

west of Preston, a point several miles east of Maquoketa, and that the only work now being done is to ballast up the road already completed.

Quincy, Alton & St. Louis.

The Alton (Ill.) Telegraph says: "It is now probable that the Quincy, Alton & St. Louis, and the Grafton & Alton Railroad Companies will be consolidated, and the road built under the bluffs from this place to Hardin; Calhoun county." This would give a line close to the bank of the Mississippi westward about 18 miles to the mouth of the Illinois, and thence up the latter stream.

Laclede & Fort Scott.

This company desires to extend its road eastward from Lebanon (the line being under contract west of that place) to some point on the Mississippi River, or to a connection with a railroad beyond. There have been some reports of a connection with the Illinois Central, by way of St. Genevieve. The Lebanon Leader says, however, that no railroad has as yet offered to take hold of the line and aid in its construction.

Kansas City & Memphis.

This company advertises for proposals for the grading, masonry and bridging of that part of the line from Springfield, Mo., west by north to Greenfield, a distance of 37 miles. Bids should be addressed to A. L. Mortimer, Chief Engineer, Springfield, Mo.

St. Louis & Keokuk.

The St. Louis Journal of Commerce says: "We are confident the Joy interest will take hold of the St. Louis & Keokuk Railroad, and complete and equip it, in as good style and in much shorter time than any other parties, if the present company are disposed to co-operate with him. If he meets with proper encouragement, and builds the road, this will give us another independent line through the very best part of St. Louis county. It will give each of the roads above named an independent connection with St. Louis; and will afford us another short line to the Des Moines Valley at Keokuk and Burlington, there connecting with the railroads already built and building westward and northward; and by the bridge at Keokuk we should have another eastern and northeastern route."

Lansing & Ionia.

A party of surveyors has been sent to locate a line for the extension of the Lansing & Ionia Railroad north of Greenville. The citizens of Muskegon will strive to make that place the terminus of the road.

Detroit, Howell & Lansing.

John J. Bush, of Lansing, has taken the contract to supply ties and bridgetimber for the part of this road between Howell and Lansing, about 35 miles.

New Orleans to Texas.

The line which the New Orleans, Mobile & Chattanooga Railroad Company is constructing across Western Louisiana is graded from Algiers, opposite New Orleans, up the Mississippi nearly to Donaldsonville, about 70 miles. Before the end of February, this section of the road is to be in operation, and the company will be entitled to a subsidy of \$750,000 in bonds from the State. Thence it is to be extended to Vermillionville.

Pithole Valley Railway.

The following announcement is made by a circular dated the 15th inst.:

"By virtue of a decree of the Court of Common Pleas of Venango county, Pa., the Oil City & Pithole Branch Railway was sold by the Sheriff of said county, October 28th, ultimo.

"The purchasers thereof, having met in compliance with the Act of Assembly, have organized a new company under the name of the 'Pithole Valley Railway Company, and the following persons compose its Board of Directors and officers: A. H. Steele, President, Tionesta; Sam'l L. M. Barlow, Charles Day, New York; Samuel Rea, J. McQueen Woods, Pittsburgh, Pa.; David Jones, Ravenna, Ohio; Joseph G. Dale, Tionesta, Pa.

"The following persons were duly elected officers for the ensuing year: A. H. Steele, President; Charles Day, Secretary; John A. Dale, Treasurer; James T. Blair, Superintendent.

"The general offices of the company are at Pithole City, Pa."

Canada Air Line.

This entire line is now under contract, and is to be completed as soon as possible.

Plymouth & Ligonier.

Articles of association have been filed with the Secretary of State of Indiana for the incorporation of the Plymouth & Ligonier Railroad Company with a capital stock of \$1,500,000 in shares of \$100 each. The proposed road is to extend from Plymouth or some point on the line of the Pittsburgh, Fort Wayne & Chicago road to Ligonier, or some place in the vicinity, on the line of the Lake Shore & Michigan Southern road, and

is to pass through the counties of Marshall, Kosciusko, Elkhart and Noble, a distance of about thirty-eight miles. The following gentlemen, residents of Plymouth, are at the head of the enterprise: J. C. Cusham, C. C. Buck, C. E. Town, C. H. Reeve, J. B. N. Klinger, and D. McDonald.

Utica, Chenango & Susquehanna Valley.

By the opening of this railroad to Norwich, trains can now run through from New York to that place via Scranton, and the coal fields of Pennsylvania are placed in direct connection with the Chenango Valley and Central New York.

ELECTIONS AND APPOINTMENTS.

—W. J. Latimer, of Big Rapids, has been appointed a mail route agent upon the Grand Rapids & Indiana Railroad.

—At the meeting of the British Institution of Civil Engineers on the 6th inst., Mr. Walton W. Evans, of New York was elected a member.

—The subscribers to the capital stock of the Portland & Rutland Railroad met at Portland on the 15th, and voted to accept the act of incorporation and to begin the construction of the road. The following directors were elected: Gilbert Mollison, of Oswego, N. Y.; William McEchorn, of Glen Falls, N. H.; R. T. Hough, of West Leyden, N. Y.; John Cain, of Rutland, Vt.; Frederick Billings, of Woodstock, Vt.; O. F. Fowler, of Bristol, N. H.; John A. Poor and N. G. Rice, of Portland; John W. Lane, of Hollis. The directors will meet in January to choose officers.

—At a meeting of the stockholders of the Houston & Great Northern Railroad Company, on the 6th inst., the following directors were elected for the ensuing year: Moses Taylor, Wm. E. Dodge, J. S. Barnes, Wm. Walter Phelps, W. M. Rice, W. J. Hutchins, C. G. Young, Cornelius Ennis, and T. F. White. The officers elected were: President, C. G. Young; Vice President, W. Walter Phelps; Manager, C. E. Noble; Financial Agent, Jacob S. Wetmore; Treasurer, B. A. Botts; Secretary, T. B. Reynolds; Assistant Secretary, T. L. Blanton.

—The directors of the Narrow Gauge Railway Company (Texas) met at Houston and elected the following officers: President, Dr. I. S. Roberts, of Houston; George Pfeifer, Esq., of New Braunfels, Vice President; H. E. Perkins, Esq., Secretary; Hon. T. H. Scanlan, of Houston, Treasurer.

—The stockholders of the Burlington, Cedar Rapids & Minnesota Railway Company met last week in Burlington, Iowa, and elected for directors: John H. Gear, C. P. Squires, J. H. Potter, J. W. Barnes, James Putman, George Millard, J. H. Davey, J. S. Hurley, H. M. Ochiltree, B. S. Cone, Jesse Holmes, E. K. Morse, Geo. Greene, Wm. Greene, J. F. Ely, W. W. Walker, S. L. Dows, D. W. C. Rowley, A. S. Belt, J. W. Traer, Henry Clews. The new Board of Directors met and elected the following officers: Hon. George Greene, Cedar Rapids, President; James Putman, Burlington, Vice President; J. H. Davey, Burlington, Treasurer; R. M. Green, Burlington, Secretary.

—D. H. Elliott, formerly of the National Land Company and the North Missouri Railroad, has been appointed General Southern Agent of the Kansas Pacific Railway. He will probably have his headquarters at Chattanooga, Tenn. His territory includes all the territory south of the Ohio River. S. A. Danforth, who has been connected with the road for some years is appointed Northwestern Agent, with headquarters at Chicago. Mr. J. W. Sweeny is appointed General Eastern Agent, with headquarters at New York.

—Mr. C. F. Clement, formerly of the ticket department of the Winona & St. Peter Railroad, has been appointed Cashier and Chief Accountant of the company. He succeeds Mr. C. T. Morris, who goes to the Pacific coast.

—Mr. H. H. Rapp has been appointed General Agent of the Rockford, Rock Island & St. Louis Railroad in Chicago. Mr. Rapp was years ago agent of the Michigan Southern, and then of the "Chicago & Galena Union" at the South Branch. Afterward he represented the Illinois Central at Cairo and has also been connected with the American Merchants' Union Express.

—The following circular, dated December 26, 1870, has been issued by Mr. E. Sweet, jr., General Superintendent of the Rockford, Rock Island & St. Louis Railroad:

"Mr. Jas. R. Jones is appointed Assistant Superintendent of this company, to take the place of Mr. H. Loosley and Mr. W. H. Pettibone, Assistant Superintendents, resigned."

Mr. Jones has been for some time in the service of the company, holding the position, previous to this appointment, of Superintendent of Construction.

—Hon. H. H. Smith has resigned the presidency of the Fort Wayne, Jackson & Saginaw Railroad Company. He is succeeded by Hon. P. B. Loomis, of Jackson, Mich.

—The Lake Pepin & Omaha Railroad Company was organized at Rochester, Minn., on the 21st inst., by the election of the following gentlemen as directors: Austin, C. H. Davidson, N. P. Austin; High Forest, T. H. Armstrong; Rochester, H. T. Horton, O. P. Whitcomb, G. W. Van Dusen, C. H. Chadbourne; Elgin, Geo. Bryant; Plainview, O. Wilcox, H. P. Wilson; Wabashaw, Jno. B. Downer, Lucas Kuhn. The directors chose the following officers: President, H. T. Horton; Vice President, O. Wilcox; Secretary, T. H. Titus; Treasurer, O. P. Whitcomb; Attorney, T. H. Armstrong.

—C. W. Huntington, of Boston, has been elected President of the Maryland and Delaware Railroad Company.

OLD AND NEW ROADS.

[Continued from page 320.]

Romeo & Western.

The Michigan Air Line company, showing no disposition to complete its line from Romeo westward to Jackson, Mich., a company with the above name has been formed which proposes to construct a line westward to Lansing to connect with the Peninsular Railroad.

Utica, Clinton & Binghamton.

It is announced that this railroad has been leased to the New York & Oswego Midland Company and the Delaware & Hudson Canal Company.

Los Angeles, San Bernardino & Central Arizona.

A certificate of incorporation of the Los Angeles, San Bernardino & Central Arizona Narrow Gauge Railroad has been filed in Sacramento. It is the intention of the incorporators, at the head of whom is General Phineas Banning, to construct the road as early as possible.

Central Pacific.

A telegram from New York reports that an important arrangement has just been consummated between the Central Pacific Railroad Company and the Pacific Mail Steamship Company. The Pacific Mail Steamship Company agrees to send all its passengers and freight from China over the Central Pacific road. The Central Pacific Railroad Company, in return therefor, agrees not to put on any opposition or other line of steamships from San Francisco to China. The first fruits of this arrangement are seen in 400 tons of teas and silks now being transferred from the Pacific Mail steamship at San Francisco, to the cars of the Central Pacific Railroad Company, for New York.

Indianapolis, Cincinnati & Lafayette.

Thomas Morris and Wm. Boaz, Receivers of the Indianapolis, Cincinnati & Lafayette Railroad, on the 33rd inst., filed in the Circuit Court, at Indianapolis, a report of their proceedings from the 26th of October to the 30th of November, an exhibit of the receipts and expenditures during that period. The Receivers pray for further instructions as to their duties, especially in regard to the surrender of the branch roads to the lessees. They were authorized to pay out of any moneys in their hands the rents due, and to become due, to save the lessees. The exhibit shows the following result on the different roads, for the time named: Receipts and expenditures, main line, gain, \$95,054.51; Martinsville Branch, loss, \$1,629.34; Whitewater Valley Branch, gain, \$1,299.15; Harrison Branch, gain, \$2,631.32; Hagerstown Branch, loss, \$97.16. The account current was referred to a Master Commissioner for detailed examination. The receivers were allowed until the 25th of January to file the inventory required by the court. The Receivers were authorized to commence legal proceedings to terminate the leases of the road or either of them. They were also authorized to pay for the killing of stock, and judgments that were valid liens upon the company. They were also authorized to borrow \$200,000 to pay the floating debt of the company, upon such terms and on such rates of interest as may be agreed upon, and to pledge such portion of the net earnings of the company as may be agreed upon to pay the principal and interest of said loans.

Milwaukee & Northern.

This road was opened for business from Milwaukee to Cedarburg with an excursion train on the 28th inst.

Kansas Pacific.

The snow blockade was broken early this week. The delay was occasioned by the formation of ice in the cuts which could not be cleared away without great labor. Snow fences are to be put up as rapidly as possible, and when these are completed there will be little danger of any considerable delay by snow.

Western & Atlantic.

This railroad, forms the sole approach to Georgia from the North, extending from Chattanooga, Tenn.,

southward to Atlanta, a distance of 138 miles. According to an advertisement of the executive department of the State, bids were received for this line for the term of twenty years, at not less than \$25,000 per month. On opening the bids, the lease was awarded to the following gentlemen: John P. King, Joseph E. Brown, Alexander H. Stephens, John T. Grant, Benjamin H. Hill, E. W. Cole, Richard Peters, Wm. C. Johnson, Wm. S. Holt, A. J. White, C. A. Nutting, Benj. May, E. Waitsfielder, W. C. Morrill, Simon Cameron, H. I. Kimball, George Cook, Thos. A. Scott, Wm. T. Mathews, Wm. B. Densmore, H. P. Plant, Thomas Allen and their associates, making in all 23. Other bids were made, but the parties failed to comply with the law by tendering efficient security. The successful company is said to be one of the strongest ever formed in the South, and the shareholders represent in their own right over \$5,000,000. Ex-Gov. Joseph E. Brown resigned his office as Chief Justice of the Supreme Court before putting in his bid, and has been unanimously elected President of the new company to whom the road is leased.

A large number of the members of the corporation are better known as politicians than as railroad men or capitalists. Joseph E. Brown and A. H. Stephens are widely known as politicians. Benjamin H. Hill is one of the most active and popular Democratic stump speakers of Georgia. H. I. Kimball is a very wealthy resident of Atlanta. Simon Cameron needs no introduction either North or South. Thomas A. Scott is the ambitious and active First Vice President of the Pennsylvania Railroad Company, who has here found a new railroad to conquer. Thomas Allen is, we suppose, the President of the St. Louis & Iron Mountain Company, which is likely to have close relations with this road.

Milwaukee & St. Paul.

The company had for two weeks the winter bridge over the Mississippi at Prairie du Chien, by which cars cross to the Iowa & Minnesota Division.

TRAFFIC AND EARNINGS.

—The following is an official statement of gross earnings and net income of the Union Pacific Railroad Company from June 1 to November 30, 1870:

	Gross Earnings.	Net Income.
June.....	\$746,450 01	\$337,526 20
July.....	643,458 44	255,108 06
August.....	664,050 83	314,720 90
September.....	728,520 93	442,362 77
October.....	719,697 80	373,093 52
November.....	670,168 31	297,438 27
Total six months.....	\$4,073,346 33	\$2,010,021 73

*A change in the system of accounts at Omaha has carried into December \$50,000 of earnings that, under the old system, belong to the month of November.

—In an address to the shareholders of the Milwaukee & St. Paul Railroad Company, the President says:

The earnings of the Milwaukee & St. Paul Railway (partly estimated for December) for the year ending Dec. 31, 1870, will be, say.....\$7,500,000
The operating expenses (November and December being partly estimated) will be, say 62 7-10 per cent.....4,703,000

Net earnings, say.....	\$2,797,000
Interest on bonds for the year is.....	1,237,000
Applicable to dividends, say.....	\$1,510,000
7 per cent on \$10,424,903 preferred stock.....	729,743
Balance.....	\$780,257
7 per cent on \$10,675,337 common stock.....	747,277
Surplus.....	\$32,980

The company now own and operate 1,018 miles of railway. The average number of miles operated by the company during 1870 is 950, making the average earnings, say \$7,900 per mile. The earnings per mile for 1869 were \$8,450. Had the earnings of 1870 been the same per mile as 1869, the gross earnings would have been, say \$8,027,500.

—The Chicago & Northwestern Railway Company publish the following comparative statement of earnings and expenses for the six months of the fiscal years 1869-70, ending Nov. 30:

	Gross Earnings, 1869.	Operating Ex., Int. rent, etc., 1869.	Net Income, 1869.
June.....	\$1,251,950 64	\$976,433 15	\$275,517 49
July.....	1,157,056 38	1,045,553 21	111,503 17
August.....	1,037,973 75	790,066 88	247,906 87
September.....	1,305,672 75	836,534 86	469,137 89
October.....	1,371,780 39	1,007,384 50	364,395 89
November.....	1,140,145 33	874,464 96	265,680 37
Total.....	\$7,264,579 24	\$5,530,977 51	\$1,733,601 73
	1870.	1870.	1870.
June.....	\$1,139,294 13	\$783,967 96	\$355,326 17
July.....	1,034,392 88	933,033 47	101,359 41
August.....	1,227,512 80	692,336 34	535,176 46
September.....	1,359,282 10	692,663 83	666,618 27
October.....	1,306,338 15	903,793 64	402,544 51
November.....	1,037,963 85	604,415 12	433,548 73
Total.....	\$7,004,774 00	\$4,590,230 36	\$2,414,543 64
Increase.....			\$489,061 91
Decrease.....	259,805 24	940,747 15	
Balance to credit of income account, May 31, 1870.....			\$541,494 29
Net earnings, six months ending Nov. 30, 1870.....			2,414,543 64
Total net earnings as of November 30, 1870.....			\$2,955,967 93
Deduct 5 per cent. dividend, payable Dec. 30, 1870.....			1,750,940 00
Surplus December 1, 1870.....			\$1,205,027 93

—The receipts of the Great Western Railway of Canada for the week ending December 2, 1870 were:

Passengers.....	\$37,597 87
Freight and Live Stock.....	54,075 16
Mails and sundries.....	2,074 50
Total receipts for week.....	\$93,737 53
Corresponding week, 1869.....	\$9,483 04
Decrease.....	\$84,254 49

MISCELLANEOUS.

—The Detroit & Milwaukee Railroad Company, advertising that a sleeping car will be attached to the "Saginaw mixed train" leaving Detroit at 11:30 p. m., adds, "Passengers desiring to retire to their berths before that time can do so."

—In the railroad bond market last Tuesday there was a panic in Union Pacific securities, which seems to have been brought about by Boston orders to sell without limit. The first mortgages declined to 72½ on the report that the January interest will not be paid, notwithstanding the fact that it has been officially promised. Land grant bonds of this road tumbled to 53, income bonds to 32, and the stock to 9. There was a rally in the afternoon, and some of the loss was recovered.

—The House of Representatives, a short time since, called for a statement of the amount of government freight transported over the Pacific railroads; also the amount sent to California by sea. The railroad statement for the year ending June 30, 1870, is as follows: There were transported over the Union Pacific Railroad 6,512 persons and 9,359 tons of stores. Total cost, \$557,537. Over the Central Pacific Railroad of California, 2,512 persons and 1,059 tons of stores. Total cost, \$87,957. Kansas Pacific Railway, 4,618 persons and 6,854 tons of stores. Total cost, \$236,744. Total cost for persons and stores, \$882,235. One-half of the cost of this transportation has been retained by the United States to pay the interest of the bonds advanced by the government to the companies; the other half has been paid at the Treasury in money.

—There is a case now before the Supreme Court of Iowa, on an appeal from Marshall county, entitled H. E. J. Boardman vs. The Chicago & Northwestern Railway Company, which involves nearly all of the vexed question concerning State control of railroad freights and fares. The Des Moines Register gives the following summary of the case:

"The plaintiff in this case brought suit to recover \$400 statute penalties, under Section 2 Chapter 169, Laws of Ninth General Assembly, for overcharges on goods from Chicago to Marshalltown. The statute of Iowa provides that, in the month of September of each year, every railroad shall fix its rates of freights and fare, which shall be posted up and so remain during the year. For receiving higher rates of freight and fare than thus established, the company shall forfeit not less than \$100, nor over \$200, for each offense to the person injured and suing therefor. On this provision of the statute, Boardman sued the Northwestern railroad. Jury found for defendant, and Judge Chase set the verdict aside and granted a new trial. From this the plaintiff appeals, on the ground that the law of the Ninth General Assembly, so far as applicable to that case, is repugnant to the Constitution of the United States and the laws of Congress, and null and void; and that Congress has the sole power to regulate commerce with foreign powers and among the several States. By act of Congress, June 15, 1866, every railroad company in the United States whose road is operated with steam, is authorized to convey passengers and freight on their way from any State to another, and to receive compensation therefor. In this case the direct issue is presented whether the State can interfere to regulate the price of freight going from this State to another, or coming from another State to this, or passing from another State through Iowa to a third State. If the court should hold that the Congress of the United States has exclusive control of such commerce and such rates of freight and fare, the great practical question, so far as nine-tenths of the business of railroads is concerned, will be settled."

—The Cincinnati Gazette says:

"What this city most needs for her commercial prosperity is first-class railroad talent in the first place, and a hearty support of it on the part of our merchants and capitalists. There is not now a line of railroad running out of this city that is controlled here, and the frequent complaints made of discriminations in freights against this city we are powerless to prevent. If we had men to take hold of our railroad system, such as the trunk East and West lines of railroads have at their heads, the trade of this city would rapidly increase. See what the President of the Baltimore & Ohio Railroad has done for the city of Baltimore, and not a whit behind is the Pennsylvania Railroad in the interest of the city of Philadelphia. Who is the coming man?"



PUBLISHED EVERY SATURDAY.

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Editorial Announcements.

Correspondence.—We cordially invite the co-operation of the Railroad Public in affording us the material for a thorough and worthy Railroad paper. Railroad news, annual reports, notices of appointments, resignations, etc., and information concerning improvements will be gratefully received. We make it our business to inform the public concerning the progress of new lines, and are always glad to receive news of them.

Inventions.—Those who wish to make their inventions known to railroad men can have them fully described in the RAILROAD GAZETTE, if not previously published, FREE OF CHARGE. They are invited to send us drawings or models and specifications. When engravings are necessary the inventor is expected to furnish his own engravings or to pay for them.

Articles.—We desire articles relating to railroads, and, if acceptable, will pay liberally for them. Articles concerning railroad management, engineering, rolling stock and machinery, by men practically acquainted with these subjects, are especially desired.

Engineering and Mechanics.—Mr. M. N. Forney, Mechanical Engineer, whose office is at Room 7, No. 72 Broadway, New York, has been engaged as Associate Editor of this journal in charge of these departments. He is also authorized to act as our agent.

Removal.—About the tenth of January next the office of the Railroad Gazette will be removed to Nos. 110 and 112 Madison Street.

Our Prospectus and Business Notices will be found on the last page.

CONSTRUCTION OF RAILROADS IN ILLINOIS DURING THE YEAR 1870.

During the past two years there has been remarkable activity in the construction of new railroads throughout the Northwest, but nowhere more than in Illinois. The special law passed by the Legislature in the winter or early spring of 1869 made it very easy to obtain aid from the country along the lines of projected roads, and the expected total and abrupt revocation of this facility by the new constitution which went into effect last August, hastened the organization and execution of schemes which otherwise might have been postponed.

Among the lines constructed are some of great importance, and others whose value will probably be greater to the constructors than to either their owners or their patrons.

It is noticeable that nearly all of the lines constructed have been south of the latitude of Chicago. The only exceptions we believe are the Geneva & St. Charles Branch of the Chicago & Northwestern, a line 2½ miles long which was opened on the 29th inst., and some work on the part of the Chicago & Iowa Railroad between Rochelle and Oregon, which was graded long ago, and was to be ironed if possible by the close of the year.

We give below an account of the work done this season:

Chicago, Danville & Vincennes.—This railroad, which is to extend from Chicago nearly due south to the Ohio River, has not made very rapid progress the past year. The year previous it was completed from Dolton, 20

miles south of Chicago, whence its trains enter Chicago over the Pittsburgh, Cincinnati & St. Louis line, to Moline, a distance of 35 miles. A few weeks ago the line was opened to St. Anne, ten miles further south, and efforts were to be made to complete it to Watska, on the Toledo, Peoria & Warsaw Railway, 62 miles south of Dolton, this winter.

Plymouth, Kankakee & Pacific.—Considerable grading has been done on the part of this line in Illinois, until lately known as the "Kankakee & Illinois River Railroad." It is to extend from Kankakee nearly due west through Dwight and Streator to Loston (on the Illinois Central 14 miles south of La Salle) and thence northward to Bureau Junction, on the Chicago, Rock Island & Pacific road 114 miles from Chicago. It is said to have support from the Pennsylvania Railroad Company.

Chicago, Pekin & Southwestern.—Some grading was done on this line last year. This year the roadbed has been substantially completed from Marseilles (on the Rock Island road eight miles east of Ottawa), south-easterly nearly to Pekin, 65 miles. Some work has also been done on the part of the line from Marseilles northeastward through Plainfield on the way to Chicago. The route is not determined, we believe, through Cook county.

Fairbury, Pontiac & Streator.—This is a line from Fairbury, a station on the Toledo, Peoria & Warsaw Railway 59 miles east of Peoria, northwestward through Pontiac to Streator, a distance of 30 miles. The grading was completed a few weeks ago.

Ottawa, Onwego & Fox River Valley.—This road, which is to be operated by the Chicago, Burlington & Quincy Company, will be completed in a few weeks from Aurora, 38½ miles west of Chicago, southwestward along Fox River to Ottawa, and thence due south to Streator, a distance of 70 miles. Of this, the section between Ottawa and Streator, 16½ miles was graded and partly ironed last year. The line is to extend north of Aurora to Geneva, nine miles, and that part of the road is graded.

Chicago & Iowa.—This road, the construction of which was commenced about the first of September, is completed, or very nearly so, from Aurora westward to Rochelle, a distance of 42 miles. Thence to Oregon, about 20 miles, the grading was done more than a year ago. A strong effort was to be made to complete the track laying on this part of the road, but there were some difficulties in the way which may not have been quite overcome so soon.

Mendota & Prophetstown.—This line, which is a branch of the Chicago, Burlington & Quincy Railroad, was not commenced until November, but it has been prosecuted with such energy that it is now nearly or quite completed. It extends from Mendota westward to Rock River at Prophetstown, a distance of 48 miles, occupying the old line of the "Illinois Grand Trunk Railroad" on which some grading had been done.

New Boston & Keithsburg.—This is another branch of the Chicago Burlington & Quincy road, extending from New Boston southward along the Mississippi six miles. This road was constructed within twelve days.

St. Charles Branch.—This is a line two-and-a-half miles long extending from the Northwestern at Geneva northward on the west side of Fox River to St. Charles. It is but just completed. The Northwestern operates it.

Rockford, Rock Island & St. Louis.—This is the longest new road in the State. Its main line extends from Sterling, 110 miles west of Chicago, by way of Rock Island, Monmouth, Bushnell, Vermont, and Beardstown to Upper Alton, 270 miles, whence it runs its trains to East St. Louis over the St. Louis, Alton & Terre Haute Railroad. It has also a line from Sagetown, nine miles northeast of Burlington, northward along the east bank of the Mississippi to Keithsburg, 20 miles. This branch, the 52 miles of the road between Sterling and Rock Island, a branch of this section 11 miles long to coal mines, and 57 miles from Beardstown southward, were completed last year. From Beardstown to Rock Island, 130 miles, most of the grading and all of the tracklaying have been completed this year.

Chicago & Alton.—During the year this company has obtained a branch from Dwight westward through Wenona to Lacon, 55 miles, and a branch of this branch southward to Washington, 27 miles. From Dwight to Wenona, 35 miles, the road was nearly completed last year. This company has also partially completed the road bed for a line from Roodhouse westward to the Mississippi, opposite Louisiana, Mo., a distance of 37 miles.

Lafayette, Bloomington & Mississippi.—This line from Bloomington nearly due east to the Indiana line, about 70 miles, has been graded and made ready for the iron within the past year. It is said to have support from the Pennsylvania Railroad Company.

Indianapolis, Bloomington & Western.—The greater part of the section of the road in this State was completed last year, but a section between Urbana and Bloomington was ironed this year, and the entire line from Pekin to Indianapolis put in operation.

Gilman, Clinton & Springfield.—This new road, extending southwestward from Gilman, on the Illinois Central, about 120 miles to Springfield, has been entirely graded this season. It is said to have help from the Pennsylvania Railroad Company.

Decatur & East St. Louis.—This railroad, extending from Decatur 108 miles in a southwesterly direction, was graded and partly ironed last year, but has been completed this season. It is now a part of the Toledo, Wabash & Western Railway.

Quincy & Carthage.—This road extends from Quincy northwestward 40 miles to Carthage. It has been completed but a few weeks. The Chicago, Burlington & Quincy Company operates it.

Pekin, Lincoln & Decatur.—This road is nearly all graded, and from Pekin to Delavan, 15 miles, is in operation. It will, when completed, form a line 65 miles long, from Decatur northward. The Toledo, Wabash & Western Company has leased it.

Illinois Farmer's Railroad.—Of this line about 18 miles have been constructed, from Jacksonville southeastward to Waverly.

Springfield & Illinois Southeastern.—The part of this road from Pana to Springfield, 42 miles, was completed last year; also a large part of the grading from Edgewood southward. During the past year the line has been completed from Edgewood to Shawneetown, 98 miles, forming a connection with the Illinois Central at the former place. During the present year, also, the company has graded a line from Springfield northwestward to Beardstown, 45 miles. This was to be completed by the end of this year.

St. Louis, Vandalia & Terre Haute.—This road was opened for business last year between St. Louis and Effingham, 98 miles. More track was laid that year, but the entire line was completed last spring. It is now one of the busiest roads in the State. Its entire length is 165 miles, 5 of which are in Indiana.

St. Louis & Southeastern.—This company had 25 miles of road, from Nashville to Mount Vernon, completed last year. The past season it has connected this section with St. Louis by a line 51 miles long, has constructed 13 miles of road from Shawneetown westward to Equality, and has let contracts for the completion of the road to Shawneetown and a branch to Evansville.

Belleville & Illinois Southern.—This road, an extension of the old Belleville road, has been completed this year from Lively, 15 miles southeast of Belleville, to Duquoin, 40 miles, and trains are now running over it and the Illinois Central, between St. Louis and Cairo.

Chicago & Rock River.—Some grading has been done on this line between Rock Falls and Amboy. A contract was let a year ago for the construction of the entire line, but the contractors did not proceed with their work.

In this enumeration we have omitted several lines which have had some grading done, our information not being very definite concerning them.

MR. FAIRLIE'S LETTER.

Mr. Fairlie has sent us a second letter, with some figures from the Milwaukee & St. Paul Railway report for the year 1867, intended to confirm the statements made in his letter which we published last week.

It will be observed that Mr. Fairlie takes certain statements which we gave as to the composition and weight of an "ordinary" American train, and makes his estimates therefrom. The figures there given were for the purpose of estimating the carrying capacity of a train and its proportion to the dead weight. Even if the number of cars there given is the "average" number in America, it will not be safe to assume that it is the average number on the Milwaukee & St. Paul or any and every American railroad. More definite reports would be necessary in order to determine anything with respect to the average car load on this line. We have not been able to find the report Mr. Fairlie refers to, but the figures in the same company's report for the year 1869 are not very much different. The figures which we gave last week are more definite, and though, of course, the addition of the engine and tender weight would make the disproportion between dead and paying weight much greater than was there shown, it would yet be much less than Mr. Fairlie claimed in his paper on the "Gauge of Railways of the Future," so far as freight trains are concerned, at least. In the examples which we gave last week, we would have probably 1.80 to 1 instead of 1.49 to 1. The difference would be much greater with passenger trains, concerning which, however, it is not easy to obtain statis-

tics. The most definite we have been able to find are those given in the report of the New York & New Haven Railroad Company for the year 1869. We quote from it the following:

Number of passengers moved one mile.....69,297,490
Miles run by passenger trains.....610,836
Average weight of passenger trains loaded.....130 tons.
Average number of passenger cars per train.....6

By dividing the number of passengers moved one mile by the number of miles run by passenger trains, we obtain 113 as the average number of passengers per train, who, at 140 lbs. each, will weigh 15,820 lbs.

The proportion of the dead to paying weight in this average train must be estimated after subtracting the weight of the baggage, express and mail cars, of which there is one on all trains, and probably two on one-half of the trains on this road (one mail and one baggage and express car). Estimating the average weight of these with their loads at 17 tons, and adding the (nearly) eight tons of passengers, we have 25 tons to subtract from the 130 tons of the average passenger train. Thus we obtain 105 tons as the weight of passenger cars, engine and tender. These 105 tons, or 210,000 lbs., carry 15,820 lbs. of passengers, a proportion of $13\frac{1}{4}$ of dead weight to one of paying load, which is certainly very far from 29 to 1 or even 25 to 1. It is only fair to say that this road has an exceptionally heavy passenger traffic, and that few other lines would be likely to make so good a showing.

The report of the Michigan Southern & Northern Indiana Railroad for the year ending February 28, 1868, to which Mr. Fairlie refers, shows an average of 70 passengers and 84 tons of freight per train, but no figures are given by which the number of cars per train can be estimated.

We hope at some future time to give fuller statistics on this subject. Railroad men will do us and the public valuable service by sending us any statistics of weight of cars, average number per train, average car and train load, etc., on their several lines.

WORK OF THE KANSAS PACIFIC RAILWAY IN 1870.

An officer of this company furnishes us with the following account of its business during the past year:

The Kansas Pacific Railway was completed, and trains commenced running through to Denver, August 15, 1870.

The line of the Kansas Pacific Railway now in operation is as follows:

Main line, Kansas City, Mo., to Denver.....629 miles
Branch, Lawrence to Leavenworth.....34 miles
Total.....673 miles

Making connection at Denver with the Denver Pacific Railway, which runs northward to Cheyenne, where it connects with the Union Pacific Railroad, forming a through line to California and the Pacific slope. The iron on the last 210 miles of road, from Eagle Tail to Denver, was laid since January 1, 1870.

The following statement shows the earnings and expenses of the road for 1870 (estimated for November and December):

Gross earnings, transportation department.....\$3,500,000
Operating expenses, transportation department.....2,400,000
Estimated net earnings.....\$1,100,000
Average number of miles in operation during the year.....557
Estimated earnings per mile—1870.....\$6,250
Earnings per mile—1869.....5,075
Estimated increase per mile—1870.....\$1,175

The importance of the business of this company and its rapid and steady increase is shown in the following statement of the gross freight tonnage of the road during three years, with the average number of miles in operation (estimated for December, 1870):

	1868.	1869.	1870.
Tons.....	124,377	175,518	301,500
Average No. miles in operation.....	403	438	557

The construction material transported was, in 1869, 21,000 tons; in 1870, 28,000 tons.

Showing an increase in commercial freight in 1870 of 119,000 tons, or 77 per cent., while the increase in mileage is only 26 per cent.

The following is the present equipment of the road, which is first-class in every respect:

Locomotive engines.....	76
Passenger cars.....	43
Sleeping cars.....	6
Baggage, mail and express cars.....	15
Freight cars.....	1,150

The road gives promise of a large increase of its business during the coming year.

The shipments of cattle for the year (estimated for December) amounted to:

Same, 1869, were.....	6,000 car loads—or 140,000 head
Estimated increase (180 per cent.).....	2,500 car loads—or 50,000 head

The sales of land during the year have been about 120,000 acres for about \$400,000, an average of \$3.33 $\frac{1}{3}$ per acre. The sales have been made entirely to actual settlers, and have been made chiefly through the agency

of the National Land Company, whose extensive facilities for cheap transportation from all parts of Europe and the United States, enable them to offer to emigrants the most superior advantages for purchasing and settling Western lands.

Completion of the Winona Eastern Connection.

The section of the La Crosse, Trempealeau & Prescott Railroad between La Crosse and Winona, better known as the "Winona Eastern Connection," is at last completed, and will be formally opened to-day. We dare not say how many times it has been announced that this road would be completed within a few months. Nearly all the grading was completed long ago, and several times the work has been resumed with the full intention of completing it; but something has caused the work to be suspended. At last the iron is actually down, a temporary bridge across the Mississippi at Winona has been constructed, and to-day trains will run through between Winona and La Crosse.

The road is important now as affording an outlet to the Winona & St. Peter Railroad, which heretofore has been weather-bound during the winter, unable to send freight and passengers eastward except by sleighs. Its eastern business could be carried westward from Winona to Owatonna, 90 miles, and thence take the Milwaukee & St. Paul road to Prairie du Chien, but this route is too circuitous. The new road gives a direct connection, by a line 27 miles long with the La Crosse Division of the Milwaukee & St. Paul Railway, about three miles above La Crosse. By it the distance from Winona to Milwaukee is 220 miles, and to Chicago by way of Milwaukee 305 miles.

But the importance of the new line will be greatly increased when the Baraboo Air Line and the St. Paul & Chicago roads are completed. It will then form a link in the shortest line between Chicago and St. Paul, and will probably receive the largest part of the traffic between Minnesota and this city.

The Master Car Painters' Convention.

At the meeting of master car painters held in Boston on the 9th of November last, little more was done than to effect an organization. There were present seventeen master painters, all from New England shops except one. The purposes of the association were declared in the following resolution:

Resolved, That we, the master car painters of the United States, have assembled here for the purpose of promoting the interests of the craft, by discussing the different methods now used in painting rolling stock on railroads—knowing that, by a general discussion of the subject, we may all profit by the experience of others, and become more proficient in our craft and of increased service to the corporations employing us.

A committee consisting of W. L. Scott, of the Boston & Lowell Railroad, Samuel Lunt, of the Fitchburg Railroad, and James Platt, of the Old Colony & Newport Railroad, was appointed to ascertain the most practical method of detecting adulterations in paints and other materials used in painting.

It was determined to hold the next annual meeting at the St. Nicholas Hotel, New York, September 6, 1871, at which all master car painters are invited to be present.

The present officers of the organization are Joseph Hill, Jr., of the Portland & Kennebec Railroad, President; S. E. Kirkpatrick, of the Vermont Central Railroad, Vice President; and M. W. Stines, of the Boston & Albany Railroad, Secretary and Treasurer.

REGISTER OF EARNINGS.

FOR THE SECOND WEEK IN DECEMBER.		
Michigan Central (284 miles), 1870.....	\$93,785 44	
" (284 miles), 1869.....	80,297 70	
Increase (16 $\frac{1}{2}$ per cent.).....	\$13,487 74	
Pacific of Missouri (355 miles), 1870.....	\$70,980 00	
" (355 miles), 1869.....	59,027 00	
Increase (20 $\frac{1}{2}$ per cent.).....	\$11,953 00	
St. Louis & Iron Mountain (210 miles), 1870.....	\$32,731 96	
" (210 miles), 1869.....	21,810 07	
Increase (50 per cent.).....	\$10,921 89	
Marietta & Cincinnati (251 miles), 1870.....	\$31,708 00	
" (251 miles), 1869.....	25,456 10	
Increase (24 $\frac{1}{2}$ per cent.).....	\$6,252 00	
FOR THE THIRD WEEK IN DECEMBER.		
Michigan Central (284 miles), 1870.....	\$95,872 5	
" (284 miles), 1869.....	75,824 92	
Increase (26 $\frac{1}{2}$ per cent.).....	\$20,047 13	
Chicago & Alton (465 miles), 1870.....	\$90,239 44	
" (465 miles), 1869.....	83,925 75	
Increase (7 $\frac{1}{2}$ per cent.).....	\$6,313 69	

Southern Ticket Agents' Meeting.

A convention of the general ticket agents of the Southern railroads will be held in Atlanta at the Kimball House on the 23d of January proximo. The object of the meeting is to revise rates.

THE INDIA NARROW GAUGE RAILROADS.

The question of the proper gauge for a secondary system of railroads in India was recently submitted by the Indian Government to four eminent persons. One of these, Mr. John Fowler, reported in favor of a 3 ft. 6 in. gauge; the others recommend a 2 ft. 9 in. gauge; which is just half the width of the standard gauge of the India.

Mr. Fowler has had experience in working railroads of gauges varying from 3 ft. to 7 ft. He recommends that the weight upon each of the driving wheels of the narrow gauge road be limited to $3\frac{1}{2}$ tons, and he believes that there need be no more than two tons upon each with a 3 ft. gauge. As to the carrying capacity of rolling stock of various gauges he says:

"On this point I would observe that it is a great mistake to assume that, between a 3 ft. 6 in. gauge and a 2 ft. 9 in. gauge there is no sensible difference of carrying power in passenger and goods vehicles. With gauges wider than 3 ft. 6 in., it is true, the full width of vehicle which can be obtained within the limits of perfect stability is seldom or never used, or with the Indian standard gauge, carriages might be 11 ft. wide; and this is the reason why, in the case of the wider gauges of 4 ft. 8 $\frac{1}{2}$ in., 5 ft. 6 in., and 7 ft., the carrying capacity of vehicles varies only slightly. With gauges of 3 ft. 6 in. and less, however, where the full width is necessarily utilized, the carrying capacity becomes exactly proportional to the square of the gauge, or as 49 is to 36, which is 63 per cent. in favor of the 3 ft. 6 in. gauge as compared to 2 ft. 9 in. In India, where the climate demands greater space for the comfort of passengers, where bulky light goods, such as jute and cotton are largely carried, and where suitability for military transport is an important consideration, this difference in carrying capacity (when obtained as in this case, without extra cost) is peculiarly valuable."

Mr. Fowler's report on the comparative cost of different gauges is especially worth noting:

It has been said, however, that the cost of a railway is in proportion to its gauge.

I almost feel it necessary, in such a communication as this, to apologise for calling attention to the fallacy of this assertion. I have, however, found such remarkable confusion or misapprehension on this point existing in the minds of persons who take an interest in this important question of light and cheap railways, that I am tempted to say a few words on the subject.

In the first place, it is obvious that *gradients* are not affected by gauge, because the same power will be required to overcome gravity whatever the gauge may be.

In the second place, *curves* are almost invariably decided by the wheel base of the engine, and not by the gauge; and in all lines of light traffic the wheel base will be so moderate as to run freely round any curve likely to be adopted. In my own practice in this and other countries, I have never met with even a single case in which I should have adopted a different curve merely in consequence of gauge.

Of the Highlands of Scotland, with which I am well acquainted, I make the same remark.

In the hilly country of Norway, where more than 120 miles of railway have been constructed, and about 300 minutely surveyed, it has not been found necessary to introduce or even to propose curves of smaller radius for the 3 ft. 6 in. gauge than 9 $\frac{1}{2}$ chains; and I need hardly say that short coupled engines, adapted for light traffic, will freely travel round curves of such a radius at a considerable speed, whatever the gauge may be. I could mention many other instances, but it is unnecessary.

India, as a rule, presents less difficulty as to curves than almost any other country, although it is quite possible that there, as elsewhere, a peculiar case of a crooked, abrupt valley might be met with, where even a small difference in the radius of a curve would make a sensible difference in cost. Such instances, however, are so extremely rare, that in practice the subject of curves may be safely eliminated from the considerations which influence a decision on the question of gauge.

The chief causes of difference of cost in railways are really as follows:

- 1st. Heavy works to obtain superior gradients, to enable the same power to take greater loads.
- 2d. Heavy works to obtain curves of large radius for high speeds.
- 3d. Heavy rails, fastenings and sleepers.
- 4th. Greater dimensions of formation, ballast, drainage, &c.
- 5th. Greater strength of bridges for greater weight and speed.
- 6th. Works for accommodating large traffic at stations.

These and similar works, and not gauge, cause the vast difference of cost between a railway for the accommodation of heavy and rapid traffic, and one to suit the requirements of light and slow traffic; and although the causes above enumerated may possibly even quadruple the total cost of a railway, it will be seen that they are only very slightly influenced by gauge.

As far as possible, no doubt, the gauge should bear an exact relation to the extent and nature of the work to be done; and (except for the purpose of avoiding a break of gauge) it would be absurd to adopt a wide gauge for light traffic or a narrow gauge for heavy traffic. I believe, however, it may be taken as the result of experience down to the present time, that no traffic has been found to be so heavy or to require so high a rate of speed that it could not be as well and as cheaply conducted on a 4 ft. 8 $\frac{1}{2}$ in. as on any wider gauge; and on the other hand, that no traffic worthy of a locomotive railway of any description is so light that it cannot

be as well and as cheaply conducted on a 3 ft. 6 in. as on any narrower gauge.

With reference to the small cost involved by the mere difference of gauge, I may mention as an illustration, the fact that in Norway the engineer-in-chief of railways for government found the total difference of cost between a 3 ft. 6 in. and a 3 ft. gauge, after a careful detailed estimate, to be from 28% to 30% per English mile. In Scotland the Duke of Sutherland, from a similar investigation by a thoroughly competent engineer, on the Sutherland & Caithness Railway found the difference to be 55% per mile.

Below 3 ft. gauge, and down to 2 ft. 9 in., the difference will be in the same proportion, viz., 14% to 15% per mile for Norway, and 27% 10s. for Scotland; thus making a total difference between a 3 ft. 6 in. and 2 ft. 9 in. gauge of 42% to 45% per mile in Norway, and of 82% 10s. per mile in Scotland.

In India the difference of cost between a 3 ft. 6 in. gauge and 1 ft. 9 in. gauge railway will vary considerably with the use of iron sleepers or wood sleepers, and to some extent also in different parts of the country. In the Indus Valley the difference will be about 45% per mile in the case of iron sleepers, and 110% in the case of wood sleepers. All these differences of cost, however, small as they are, would be more than counterbalanced by the additional length and cost of the sidings required in consequence of the less carrying capacity of the 2 ft. 9 in. gauge.

This result will be a surprise to persons not really conversant with the question, but not so to experienced engineers, who are aware that with equal weights and equal speed all the important items of construction and costs are constants.

For short distances and peculiar traffic it has been found that a very narrow gauge, 1 ft. 11½ in.—as in the case of the Festiniog Railway—may be worked by locomotive engines; but it is a mistake to suppose that, because the Festiniog line is very narrow, it is therefore very light and cheap. For instance the rails, which constitute the largest item of cost in a cheap railway, are 25 per cent. heavier on that line than those used on the Canadian, Queensland and Norwegian 3 ft. 6 in. gauge lines.

With respect to the weight of rails for the light railways in India (whatever the gauge may be), it would, I consider, be desirable to avoid the extreme lightness of the rails used on some of the Norwegian lines (36 lb.), where sleepers are very cheap, and also the heavy rails of the Festiniog line (49 lb.), where the rails have to sustain the blows occasioned by the excessive overhanging weight of the rolling stock, and to assume a weight of about 42 lbs. per yard. This weight I have adopted in my comparative calculations, although in certain districts where sleepers are very costly it might be better, and even cheaper, to increase this weight, and, under certain circumstances of comparative cost, to use steel instead of iron rails.

In our visit to Norway we examined very minutely the railways which have been constructed, and are now being worked, on the 3 ft. 6 in. gauge. The aggregate length of those railways is about 120 English miles; and it is only justice to Mr. Carl Pihl to say that the plans and details of the works, the stations and the rolling stock (the whole of which were designed by him, and executed under his immediate superintendence, reflect the highest credit on his scientific attainments and practical skill. It is now generally admitted in Norway, after years of keen controversy as to gauge, that the 3 ft. 6 in. lines have proved in every respect a complete success for the light traffic of that country.

In concluding the consideration of this portion of the subject, I cannot hesitate to advise that in all cases where circumstances justify the introduction of a second gauge in India, a width of 3 ft. 6 in. be adopted, on the clear ground that it is not greater in first cost of works and rolling stock than a gauge of 2 ft. 9 in., and is greatly superior in carrying capacity, convenience, and economical working.

Mr. Fowler gives detailed estimates of the cost of light railroads for a line of 480 miles, and another of 270 miles, in India. These estimates are both for a 3 ft. 6 in. and for a 5 ft. 6 in. gauge, both to be laid with rails weighing 42 lbs. to the yard.

The following is a summary of his estimates:

Kotree and Moulton Line, 480 miles.		
	5 ft. 6 in.	3 ft. 6 in.
Earthwork.....	£141,698	£123,800
Permanent way.....	1,186,560	945,120
Bridges.....	390,000	350,000
Telegraphs, road crossings and fencing.....	75,300	75,300
Stations and workshops.....	300,000	268,100
Engineering and agency.....	261,682	220,315
Contingencies (10 per cent.).....	235,514	198,243
Rolling stock.....	465,750	460,000
Total for 480 miles.....	£3,056,404	£2,640,578
Total average cost per mile.....	6,367.5	5,501.4

Thus the difference in favor of the 3 ft. 6 in. gauge on this long line appears to be £415,726, or £856.1 per mile—about \$4,280.

Mr. Fowler continues:

The estimates for a line 270 miles long, from Lahore to Peshawur, gives the total cost with a 5 ft. 6 in. gauge, £2,435,780; with a 3 ft. 6 in. gauge, £2,221,297. The cost per mile in this case is £9,021.3 for a 5 ft. 6 in. and £8,227 for a 3 ft. 6 in. gauge road.

In the comparative estimates for the accommodation of equal traffic at equal speeds, it will be seen that I have adopted the same weight of rail for gauges of 5 ft. 6 in. and 3 ft. 6 in.; as it appears to me that, unless an equal strength of permanent way be provided for equal duties, the comparison is worthless. The comparison, however, is to a small extent unavoidably in favor of the narrower gauge, because wooden sleepers for a gauge of 5 ft. 6 in. must be somewhat wider and thicker if they are in reasonable proportion to their length, and therefore a greater strength and support is

necessarily given to the rails. This will more than compensate for the slight additional weight occasioned by placing the same power on a wider gauge.

In the case of under bridges (over bridges are almost unknown in India) scarcely any difference in cost will be found between wide and narrow gauges when the weight of engines and vehicles, and the traffic are the same; and as between the gauge of 3 ft. 6 in. and any smaller gauge, it is difficult even to suppose a case in which any difference of cost could possibly arise, as the dimensions for strength and stiffness must always include a width sufficient for a railway of at least 3 ft. 6 in. gauge.

As regards estimate of rolling stock on the two gauges, it will be seen that I have added slightly to the cost of the engines (of the same power) for the 3 ft. 6 in. gauge when applied to the 5 ft. 6 in. gauge. The amount of this addition is founded upon actual offers received. For the vehicles of the 5 ft. 6 in. gauge, I have taken equivalent accommodation to that on the narrow gauge as the basis of estimate, and have assumed that the existing vehicles in India would pass over any light 5 ft. 6 in. line. It would clearly be erroneous to estimate the same number of vehicles with reference to their carrying capacity.

With respect to engines and vehicles on the 3 ft. 6 in. and 2 ft. 9 in. gauge, I have not made any difference in price in the estimate, although, if the details were worked out, a substantial advantage would belong in this respect to the vehicles on the 3 ft. 6 in. gauge, provided of course, that equal stability be given in each case.

On the important question of the cost of working the same traffic on different gauges, we have experience in England with all gauges up to 7 ft.; and I have no hesitation in advising that, in considering at any time the question of extending the standard gauge to 5 ft. 6 in. with a light permanent way, or applying a narrow gauge line of 3 ft. 6 in., the cost of working may always be assumed to be the same.

The other members of the commission to whom this subject was referred, Messrs. Strachey, Dickens and Rendel, recommend that a 2 ft. 9 in. gauge be adopted, with rails weighing 36 pounds to the yard. They urge that for the secondary system the cheapest line which will be sufficient for the probable traffic should be adopted, and they believe that a 2 ft. 9 in. line will be sufficient and sensibly cheaper than one 9 inches wider. The maximum weight per driving wheel they would have limited to three tons and the speed to about 15 miles per hour. The sleepers should be 8 by 4 inches, 5 ft. 6 in. long, and 3 feet apart from centre to centre.

They would have the locomotives with not less than four wheels coupled, and with six or eight when greater adhesion is needed, with driving wheels about three feet in diameter.

Passenger carriages might be 18 ft. 6 in. long, and 6 ft. wide, in both cases externally, their internal height being 6 ft. They would be on four wheels, the wheel base being 9 ft. They might be divided into four compartments for third class to carry 32 passengers; into three compartments for second class, to carry 18 passengers; and might be specially arranged for first class, to carry six first class passengers for short journeys, or three for long journeys, with luggage and servants, with washing and closet conveniences. The weight of such carriages would, it is estimated, not exceed 3½ tons. Where the traffic, or the nature of the line rendered it desirable, the carriages might be double the above length, and carried on bogies.

The ordinary goods wagons should be equal to a load of 5 tons, the available internal capacity of the covered wagons being about 300 ft. This would give a wagon about 14 ft. long by 5½ wide inside. We suggest that the wagons should be designed, in the first instance, without bearing springs. The dead weight of the covered wagon need not exceed 2½ tons. As in the case of the passenger stock, longer wagons carried on bogies, or shorter ones might be used, as the traffic required.

These members report as follows the comparative cost of lines 480 miles long with 2 ft. 9 in. and 5 ft. 6 in. gauge:

	Road.	Rolling Stock.	Total.
With 45 lb. rail, 5½ ft. gauge.....	£2,650,000	£680,000	£3,330,000
With 36 lb. rail, 2½ ft. gauge.....	2,020,000	460,000	2,480,000

This is at the rate of £5,520 for road and £1,443 for rolling stock per mile for the wide gauge, and £4,200 for road and £962 for rolling stock per mile for the narrow gauge.

Engineering, in commenting on these reports, favors that of Mr. Fowler, and says:

"We find that, in recommending a special gauge of their own—half that, be it observed, of the existing Indian gauge, and the mean between the Festiniog and Norwegian lines—Messrs. Strachey, Dickens and Rendel attempt to give a thoroughly practical value to their report, by dwelling in detail upon the class of rolling stock they recommend. We have already shown that rolling stock not only to be such as few engineers would venture to propose, but also such as few wagon and carriage builders would care to construct, and we cannot help feeling that the value of their report is considerably lessened by the recommendation of such stock. Moreover, we are not quite clear why Messrs. Strachey and Dickens selected 2 ft. 9 in., unless they considered that they had discovered a happy mean between the extremely narrow Festiniog and the 3 ft. 6 in. lines, and

one, moreover, which being just half the existing Indian gauge, would offer special facilities in transforming the present broad into the anticipated narrower railway systems.

"We have already shown that in constructing an equally efficient line, the saving by the adoption of the 2 ft. 9 in. gauge would be such as not to warrant its introduction on the ground of economy. We have shown, that with respect to carrying capacity, the 3 ft. 6 in. gauge is far superior, and in special and in all-important particulars immeasurably so, and we believe that Messrs. Strachey and Dickens would also have arrived at a similar conclusion if they had viewed the case in its broadest aspect."

Some of those making the majority report have considerable influence with the Indian Government, which they have served, we believe, and it is perhaps most probable, that their report will be adopted, and that the 2 ft. 9 in. gauge will be tried on a large scale. Which ever may be adopted, the result of the experiment, for such we must consider it, will be looked for with much interest. If it shall not be successful as an improved system, it will at least teach the world a lesson very effectively.

Safety Valves.

The following is the report of the Committee on Safety Valves made at the last meeting of the Master Mechanics' Association. The report is signed by R. Wells, of the Jeffersonville, Madison & Indianapolis Railroad, and J. H. Setchell, of the Little Miami, Columbus & Xenia Railroad:

Your Committee on Safety Valves, re-appointed at the last annual meeting, with instructions to report such changes in their last report, or additions thereto, as the experience of another year might prove to be necessary, would respectfully state, that from the answers to interrogatories addressed to the different master mechanics relative to this subject, as well as the experience of the different members of the committee, that no material change of that report or addition to it seems to be necessary. Your committee would however recommend that where the ordinary lever and spring balance is used in connection with a safety valve that the bearings of the lever should be "knife edged."

The subject of steam, mercury, and water gauges, and also the investigation of the comparative merits of the different kinds of blowers, was referred to the above committee, but for want of sufficient time on the part of the committee to give the subject a thorough examination, we deemed it advisable to take no action upon those subjects, but would respectfully request that your committee be granted further time, or that these subjects be referred to a special committee.

The report was accepted, and the following discussion ensued:

Mr. Sellers, D. M. V. R. R.—I remember the report of last year, and it seems to me that there was nothing said in reference to the desirability of having a safety valve out of the control of the engineer.

The President—Last year the committee recommended that one safety valve should be out of the control of the engineer. One or both.

(The Secretary here read that part of the report of last year, relating to the safety valve.)

Mr. Wells, J. M. & I. R. R.—I will state, for the benefit of those who were not here, that this report to-day is in addition to the one made last year. The committee was continued with instructions to make such alterations in the report made last year, as the experience of another year, in their opinion, might warrant. The committee addressed circulars to the various master mechanics, during the summer, and from the replies they made to the questions propounded to them, this report was made out.

Railroad Manufactures.

Gill & Bidwell have just established a car-wheel foundry, in Alleghany City, using Hanging Rock pig, which costs \$62 per ton, and turning out now 50 wheels per day, which can be increased 150. They make a specialty of passenger car wheels.

The Bethlehem Iron Company is making rails for the Northern Pacific Railroad.

The Barnum & Richardson Company, at their works on Madison street, Chicago, turn out 90 car wheels per day, made of Salisbury, Conn., charcoal pig.

The Indianapolis Rolling Mill employs 400 men.

—In the case of the State of Maryland against the Baltimore & Ohio Railroad, to recover the payment in gold of \$3,000,000 of preferred stock in the road, and sued by the State, brought in the Baltimore Superior Court, a decision has been delivered in favor of the State. The principal points reached by the defence were that the company were not obliged to pay in gold where not expressed by statute, and that the State was estopped from claiming payment in this way because of accepting payment in several instances in current money. The case will be appealed.

—The telegraphers of the Chicago, Burlington & Quincy Railroad Company gave the company's Superintendent of Telegraph, Mr. F. H. Tubbs, a \$330 gold watch and chain as a Christmas present last Saturday. The presentation was made at Galesburg.

Railway Expenditure—The Traffic Charges.

In the preceding articles upon this important subject of railway expenditure, we have pointed out three great branches of outlay which reduce the gross receipts from the large sum which they represent in proportion to the capital invested to the modest proportions which find their way as dividend into the pockets of shareholders. The trade of carriers, whether of goods or passengers, should be a highly remunerative one for those who invest in it. There are few, if any, occupations which are more remunerative than that of working a railway; for even with all its attendant expenses it would appear that about one half of the gross receipts remains in the shape of profits. That these profits are divided among the shareholders is due of course to the fact of the enormous capital required to be invested in this trade. Fifty per cent. of the gross receipts upon our railways does not, owing to the heavy expenditure required originally in the purchase of the means for carrying on the trade, represent more than about 4 per cent. on the large amount of capital sunk in the business. A sum of about £500,000,000 has been expended in the construction of railways; the gross yearly revenue from the business is equal to nearly £41,000,000, or about 8 per cent. of the capital, but the net receipts remaining as dividend on this capital are only equal to one half of that sum, 50 per cent. of the receipts being absorbed by the working charges. The heads of expenditure already noticed are:—

Locomotive.....	£5,900,000
Maintenance of way.....	3,764,000
Carriages and Rolling stock.....	1,632,000

These three items together absorb over £10,500,000. To these a fourth has now to be added. It is a formidable head of expenditure, and is made up of a number of other charges, each of which, however, is indisputably necessary for carrying on the business of the road, and earning the large sum already mentioned. We refer to the head of traffic charges. It amounts to £4,879,158 in England and Wales, £594,129 in Scotland, and £16,059 in Ireland, or together a gross sum of very nearly five and a half millions—the precise figures being £5,489,346. This head of expenditure is larger by £300,000 than the total outlay upon the locomotive, which is the active force employed upon the railway to do the work, it is £1,800,000 more than the entire cost of the permanent way, and it is three and a-half times greater than the sum expended in keeping in repair the carriages and rolling stock in which the traffic of the line is carried. This large item of expenditure includes, among other things, salaries and wages, fuel, lighting, water and general stores, clothing, horses, harness, vans, provender, wagon covers, ropes, repairs of hoists, warehouse charges, station expenses, and a small host of miscellaneous items necessary and incidental to the conduct of the traffic of the road. A year's outlay upon one mile of railway under this comprehensive head is rather over £395. A calculation made in a pamphlet published by Mr. Haggard last year gave the following as the particulars of one year's outlay upon a mile of railway open and at work:—

Traffic charges.....	£ 295 17 6
Locomotives.....	384 8 11
Maintenance of way.....	264 11 3
Repairs and renewals of carriages.....	118 13 8
Rates and taxes.....	39 17 6
Government duty.....	33 10 7
Compensation for personal injury.....	24 7 7
Compensation for goods.....	11 13 8
Legal and parliamentary.....	24 2 6
Miscellaneous.....	81 1 6
	1,393 4 0

The gross receipts being £2,771 2s. 2d., of which £1,253 18s. 1d. was received from passengers, horses, mails, dogs and luggage, and £1,512 4s. 1d. for goods, minerals, merchandise, and live stock.

This large branch of expenditure is one which, unlike other departments of the railway system, does not admit of comparison or calculations of relative percentages of the different railways. The amount varies greatly in proportion to the nature of the business transacted. A passenger line has no expenditure for horses or harness, vans, or for other matters necessary for the conduct of the goods traffic. The station expenses upon leading lines differ, of course, very much from the similar expenses required on a mineral line; warehouse charges are matters that concern the collection and delivery of goods and merchandise. All that can be done in regard to economy in this department rests with the traffic managers of the lines; and we believe that as a rule they do look very closely into each item of expenditure in their department. The wear and tear that take place in the conduct of the traffic of a railway is enormous, and it behooves the managers and superintendents of our railways to do all in their power to keep down the expenditure in all details that come under their immediate notice. In spite of all that can be done there will undoubtedly be a very large amount of waste in the business of a large company which would not take place if the "master's eye" could watch over everything, as in the case of a private concern. This same amount of watchful economy cannot, however, be expected in the management of a business by those who have only a remote interest in its success.

We cannot but think that some good result and some check upon wasteful expenditure would be provided if the companies were to call upon the traffic managers to make reports similar to those furnished by the engineers respecting the permanent way, and the locomotive and carriage superintendents respecting their departments. All the half-yearly reports give particulars of the rolling stock and certify as to its condition. There are no returns, for instance, of the number of horses, tarpaulins, vans, and other matters of that kind, and no detail is furnished of the cost of horse provender and other items which would enable the proprietors to judge how far requisite economy is practiced in what must necessarily be a very large item of expenditure. As we have said before, we have no doubt these matters are very carefully looked into by the head of the department. The London & Northwestern is about the only company which furnishes information, beyond the actual rolling stock upon the railways, in connection with its traffic. We find that it has 345 carts, 20,696

sheets or tarpaulins, 691 horses—more than the force of a regiment of cavalry—and 47 parcel carts. The cost returned under the head of "traffic charges" is:

Horses, harness, vans, provender, etc.....	£28,271
Wagon covers, ropes, etc.....	11,705

These are not unimportant items even in the great totals of this company, and which, in the matter of traffic charges alone, amount to £483,433. The following are the items which go to make up this large total on the London & Northwestern:

TRAFFIC EXPENSES.	
Salaries, wages, &c., coaching and police departments.....	£124,025
Fuel, lighting, water and general stores.....	32,217
Clothing.....	5,230
Printing, stationery, and tickets.....	13,563
Joint station expenses.....	5,079
Miscellaneous expenses.....	5,127
	£185,335

Salaries, wages, &c., merchandise department.....	£190,260
Fuel, lighting, water, grease, and general stores.....	13,714
Clothing.....	309
Printing, stationery, &c.....	7,740
Horses, harness, vans, provender, &c.....	38,271
Wagons, covers, ropes &c.....	11,705
Joint station expenses.....	6,023
Agents' commission.....	6,223
Hoists, hydraulic cranes, &c.....	11,081
	£294,598

Making together a total of.....£483,433

In amount these traffic charges stand at the head of all other branches of expenditure on this line, as will be seen from the following:

Traffic charges.....	£483,433
Locomotive.....	407,033
Maintenance of way.....	317,340
Repairs and renewals—carriages.....	129,653
General charges.....	93,730

The following shows the expenditure under the head of traffic as compared with other charges on fifteen of our leading lines of railway:

	Traffic.	Locomotive.	Maintenance.	Carriages.
Caledonian.....	£230,050	£263,787	£196,575	£261,733
Great Eastern.....	316,164	266,638	177,341	84,308
Great Northern.....	292,309	337,160	301,181	90,297
Great Western.....	551,598	478,454	397,401	184,081
Lancashire & Yorkshire.....	461,823	268,503	215,549	65,145
London & Northwestern.....	983,350	784,779	511,466	253,535
London & Southwestern.....	353,252	392,552	186,924	59,078
London & Brighton.....	182,199	185,271	107,604	45,900
London, Chatham & Dover.....	102,341	81,692	77,329	30,674
Manchester & Sheffield.....	143,973	109,374	75,663	36,587
Midland.....	469,400	442,673	360,025	101,818
North British.....	221,064	178,402	193,200	86,616
Northeastern.....	366,733	613,639	380,477	271,517
Southeastern.....	300,043	177,728	121,472	44,600
Glasgow & Southwestern.....	77,621	57,506	91,835	21,065

—London Railway News.

—Passengers who left Denver by the Kansas Pacific Railroad on the 15th inst., only arrived at St. Louis on the night of the 27th, having been snow-bound on the plains ten days. The weather was extremely cold, and the snow-drifts ten feet deep.

WANTS.

WANTED—A complete file of the **RAILROAD ADVOCATE** published in New York by Zerah Colburn about 15 years ago. A purchaser can be found by applying at this office personally or by letter.

WANTED Every Railway Traveler in the United States and the Dominion of Canada wants every railway company to use the **Thomas Safety Baggage Check**. It is in use on over sixty of the best managed roads in the country and has been during the past three years, and not one piece of baggage to which this check has been attached has been lost or miscarried. Every railroad man upon whose road it is in use says:

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Greene, and Dade County Divisions.**

Sealed Proposals will be received by the undersigned, at his office, in the City of Springfield, Greene County, Mo. up to

12 o'clock, noon, January 7, 1871,
for the Grading, Masonry, Bridging, Trestle and Timber work, Piling &c., necessary to prepare, ready for the ties, iron, &c., or Permanent Way, all that portion of the KANSAS CITY & MEMPHIS RAILWAY, lying between Jefferson Street, in the City of Springfield, Greene Co., Mo., and the Mt. Vernon road, in the Village of Greenfield, Dade County, Mo.

Proposals will be received for the work in each Section, (of about five (5) miles) or for all the work now advertised (about thirty-seven (37) miles); but parties making Proposals for all the work, will also be required to make Separate ones for the work in each Section.

Proposals should be made to do the work for a stated price per unit of measure.
Blank forms, setting forth the different items of work for which Proposals will be received, will be furnished on application, and Plans, Profiles, Specifications, &c. of the work can be seen on and after the

25th day of December, 1870,
at the office of the undersigned, where also, all necessary information can be obtained, to enable parties to make an examination of the country along the proposed route.

Proposals will be received for the Bonds of Greene and Dade Counties, Mo., or for Cash.

Right is reserved to reject any or all Proposals that are deemed unsatisfactory.

A. L. MORTIMER,
Chief Engineer, K. C. & M. Ry.
CHIEF ENGINEER'S OFFICE,
SPRINGFIELD, Greene Co., Mo.,
December 16th, 1870.

VAN NOSTRAND'S**Eclectic Engineering Magazine,**

Commenced January, 1869.

Consists of Articles selected and matter condensed from all the Engineering Scientific Serial publications of Europe and America.

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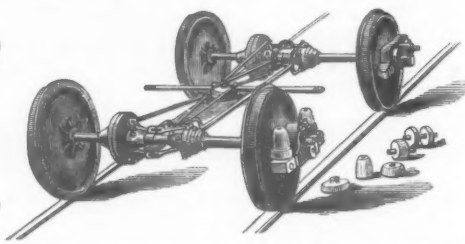
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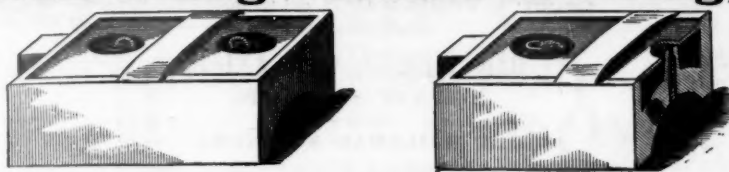
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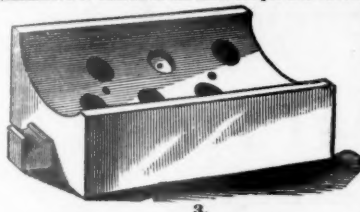
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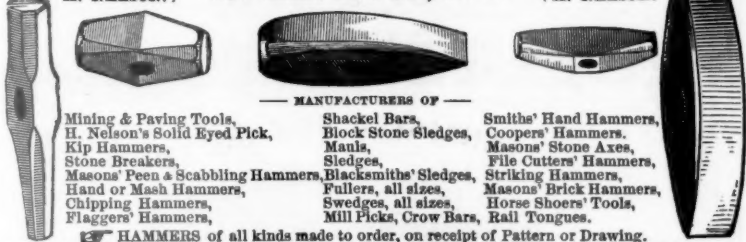
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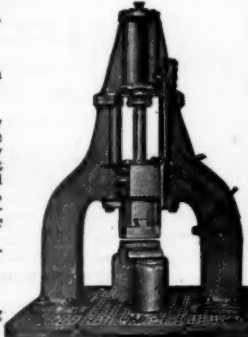
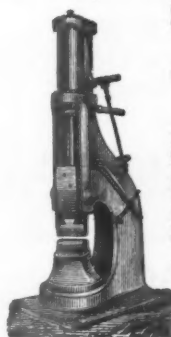
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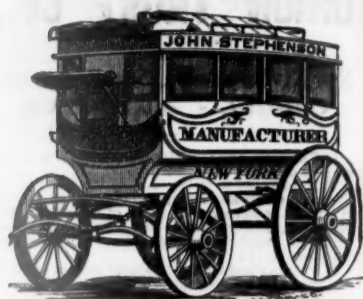
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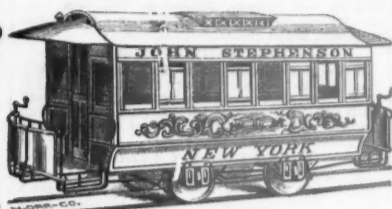
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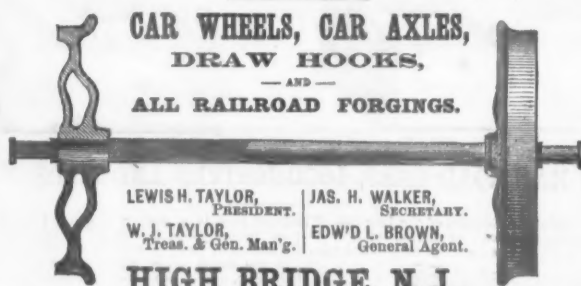
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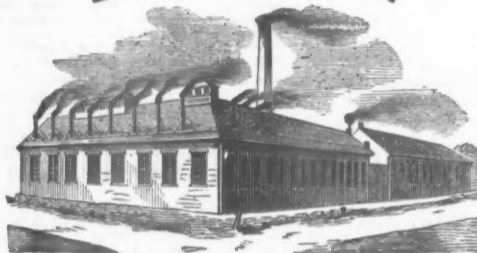
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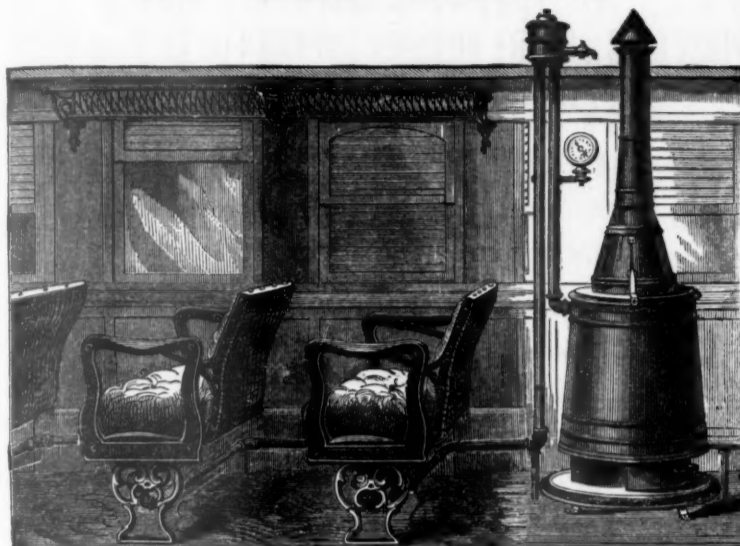
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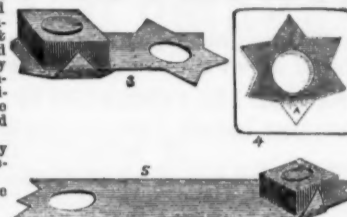
THE UNION PATENT STOP WASHER,

Manufactured at Coatesville, Chester Co., Pa., on the line of the Pennsylvania Central R. R., has now stood the test of practical use on the above road, the Philadelphia, Wilmington & Baltimore and Philadelphia & Reading Railroads, for the past two years, and proved itself to be what is claimed for it—a perfect security against the unscrewing or receding of nuts. Its simplicity, efficiency and cheapness over any other appliance for the purpose should recommend it to the attention of all persons having charge of Railroad tracks, cars and machinery.

It is especially adapted to, and extensively used by leading Railroads of the country for the purpose of securing nuts on railway joints.

The accompanying cuts show the application of the Washer. For further information, apply to

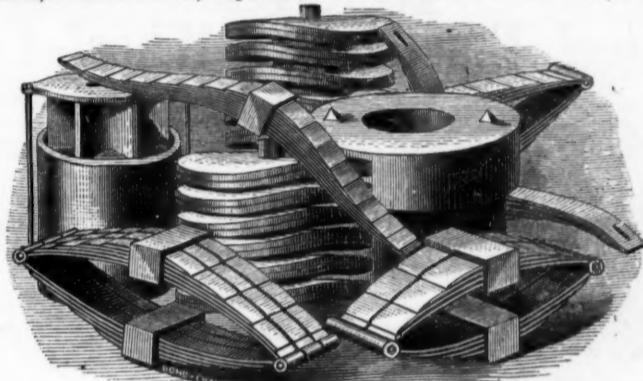
A. GIBBONS, Coatesville, Pa.



The Chicago Spring Works.

McGREGOR, ATKINSON & CO., Proprietors.

OFFICE: No. 128 Lake Street, Chicago

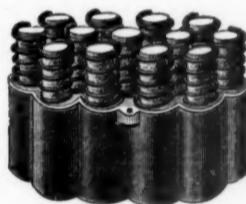


MANUFACTURERS OF

EXTRA TEMPERED LIGHT ELLIPTIC CAST STEEL SPRINGS AND THE "DANIELS" PAT. CAR SPRING.

Union Car Spring Mfg Co.

Sole Proprietors of the



Wool-Packed Spiral.



Hebbard.

HEBBARD CAR SPRING!

Offices: No. 4 Dey St., New York, and 19 Wells St., Chicago.

FACTORIES: JERSEY CITY, N. J., and SPRINGFIELD, MASS.

Vose, Dinsmore & Co., NATIONAL SPRING WORKS,

MANUFACTURERS OF

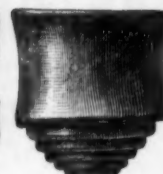
VOLUTE BUFFER, INDIA RUBBER, RUBBER CENTER SPIRAL, COMPOUND SPIRAL, "DINSMORE,"

AND OTHER

RAILWAY CAR SPRINGS.



"Dinsmore" Spring.



Volute Buffer Spring.



Group Rubber Center Spiral Spring.

No. 1 Barclay St., NEW YORK.

No. 15 La Salle St., CHICAGO

WORKS ON 129th AND 130th STREETS, NEW YORK.

GENERAL FREIGHT DEPARTMENT.

The Illinois Central Railroad

ARE PREPARED TO TAKE FREIGHT FOR

**Cairo, St. Louis, Peoria,
BLOOMINGTON, SPRINGFIELD, JACKSONVILLE,**

And All Points in the Central and Southern parts of the State;

MOBILE & NEW ORLEANS BY RAIL OR RIVERAnd ALL POINTS on the MISSISSIPPI below CAIRO. Also, to
Freeport, Galena and Dubuque.Freight Forwarded with Promptness and Despatch, and
Rates at all times as LOW as by any other Route.BY THE COMPLETION OF THE BRIDGE AT DUNLEITH,
THEY ARE ENABLED TO TAKE FREIGHT TO ALL POINTS WEST OF DUBUQUE
WITHOUT CHANGE OF CARS!DELIVER FREIGHT IN CHICAGO ONLY at the FREIGHT DEPOT of the Com-
pany, foot of South Water St. Parties ordering Goods from the East should have the packages marked:**"Via Illinois Central Railroad."**For THROUGH BILLS OF LADING, and further information,
apply to the LOCAL FREIGHT AGENT at Chicago, or to the undersigned.

M. HUGHITT, Gen. Supt.

J. F. TUCKER, Gen. Freight Agt.

**MOORE
Steel Elastic Car Wheel Co.**

OF NEW JERSEY.

Proprietors of

MOORE'S PATENT

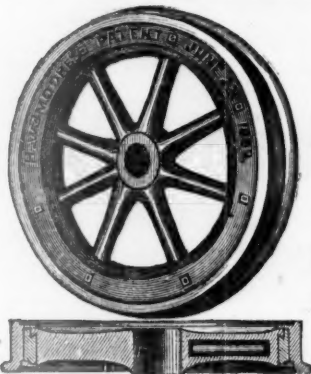
FOR THE MANUFACTURE OF

ELASTIC CAR WHEELS,

FOR PASSENGER AND SLEEPING COACHES.

Noiseless, Safe, Durable and Economical.

Also, Manufacturers of

CAR WHEELS OF EVERY DESCRIPTION.H. W. MOORE, President.
JAS. K. FROTHINGHAM, Secretary.
F. W. BLOODGOOD, Treasurer.Works, cor. Green and Wayne Sts., JERSEY CITY, N. J.
P. O. Address—Box 129, Jersey City, N. J.**American Compound Telegraph Wire.**

More than 3000 Miles now in Operation.

Demonstrating beyond question its superior working capacity, and great ability to withstand the
elements. For RAILROAD LINES, connecting a single wire with a large number of Stations, and for long
circuits, this wire is peculiarly adapted; the large conducting capacity secured by the copper, with
other advantages, rendering such lines fully serviceable during the heaviest rains.Having a core of steel, a small number of poles only are required, as compared with iron wire con-
struction, thereby preventing much loss of the current from escape and very materially reducing cost
of maintenance. OFFICE AMERICAN COMPOUND TELEGRAPH WIRE CO.BLISS, TILLOTSON & CO., Western Agents,
247 South Water Street, Chicago.CHAS. J. PUSEY, P. O. Address—Box 5222. EDW'D H. PARDEE
Pusey & Pardee,
74 BROADWAY, NEW YORK.**American and English Rails,
LOCOMOTIVES AND CARS FISH-PLATES, SPIKES, &c.**

—SOLE AGENTS FOR—

**Atkins Brothers' Pottsville Rolling Mills, and G.
Buchanan & Co., of London.**Special attention given to filling orders for small T and STREET RAILS, of every
weight and pattern.

OLD RAILS BOUGHT OR RE-ROLLED, AS DESIRED.

J. E. FRENCH.

W. S. DODGE.

D. W. CROSS.

Winslow Car Roofing Company.**PATENT IRON CAR ROOFS.**

Established, 1859.

No. 211 Superior St. CLEVELAND, O.

Over 20,000 Cars covered with this Roof! We claim that these
Roofs will keep Cars dry, and will last as long as the
Cars they cover without any extra expense
after once put on.

SEND FOR CIRCULARS.

**THE
"RED LINE!"**

—RUNNING OVER THE—

Michigan Southern and Lake Shore R. R.'s,

—WAS THE—

**FIRST LINE to CARRY FREIGHT BETWEEN the EAST and WEST,
WITHOUT CHANGE OF CARS!**

CARS RUN THROUGH TO

**NEW YORK AND BOSTON,
IN FOUR AND FIVE DAYS!**

Contracts made at the Offices of the Line.

C. Shutter, Agent,
247 Broadway, New York.A. Cushman, Agent,
Old State House, Boston, Mass.

W. D. MANCHESTER, Agent, 54 Clark St., Chicago.

Great Central Route.**"BLUE LINE."**

ORGANIZED JANUARY 1, 1867.



OWNED AND OPERATED BY THE

**Michigan Central, Illinois Central, Chicago, Bur-
lington & Quincy, Chicago & Alton, Great
Western (of Canada), New York Central,
Hudson River, Boston & Albany, and Provi-
dence and Worcester Railroads.**THE "BLUE LINE" is the only route that offers to shippers of freight the advantages of an
unbroken gauge through from Chicago to the Seaboard, and to all Interior Points on the line of Eastern
Connections beyond Suspension Bridge and Buffalo. All Through Freight is then transported between
the most distant points of the roads in interest.**WITHOUT CHANGE OF CARS!**The immense freight equipment of all the roads in interest is employed, as occasion requires, for the
through service of this Line, and has of late been largely increased. This Line is now prepared to extend
facilities for the transit and delivery of all kinds of freight in Quicker Time and in Better Order than
ever before.**The Blue Line Cars**are all of a solid, uniform build, thus largely lessening the chances of delay from the use of cars of a
mixed construction, and the consequent difficulty of repairs, while remote from their own roads. The
Blue Line is operated by the railroad companies who own it, without the intervention of intermediate
parties between the Roads or Line and the public.Trains run through with regularity IN FOUR OR FIVE DAYS to and from New York and
Boston. Special care given to the Safe and Quick Transport of Property Liable to Breakage or Injury,
and to all Perishable Freight.Claims for overcharges, loss or damage, promptly settled upon their merits. Be particular and direct
all shipments to be marked and consigned via**"BLUE LINE."**FREIGHT CONTRACTS given at the offices of the company in Chicago, New York
and Boston.

J. D. HAYES, GEN. MANAGER, Detroit.

C. E. NOBLE, 349 Broadway, N. Y. P. K. RANDALL, 409 Washington St., Boston.
GEO. E. JARVIS, 91 Lake St., Chicago. W. W. STREET, 91 Lake St., Chicago.
N. D. MUNSON, Quincy, Ill. J. JOHNSON, Cairo, Ill.

THOS. HOOPS, GEN. FR'T AGT. Michigan Central Railroad, Chicago.

A. WALLINGFORD, AGT. M. C. & G. W. R. R., No. 91 Lake St., Chicago.

N. A. SKINNER, Freight Agent Michigan Central Railroad.

Empire Line.

THE EMPIRE TRANSPORTATION COMPANY'S

Fast Freight Line to the East

—AND—

**TO THE COAL AND OIL REGIONS,
Via Michigan Southern, Lake Shore, and Philadelphia & Erie R. R.'s,
WITHOUT TRANSFER!**

Office, No. 72 LaSalle Street, Chicago.

GEO. W. RISTINE, Western Superintendent, Cleveland, Ohio.

W. G. Van Demark, 265 Broadway, New York. E. L. O'Donnell, Baltimore, Md.
G. B. McCulloh, 43 South 5th St., Philadelphia. Wm. F. Smith, Erie, Penn.

JOHN WHITTAKER, Pier 14 North River, New York.

JOSEPH STOCKTON, Agent, Chicago.

W. T. HANCOCK, Contracting Agent.

WM. F. GRIFFITHS, Jr., Gen. Freight Agent, Philadelphia.

CHICAGO & NORTHWESTERN R. W.

Comprising the PRINCIPAL RAILROADS from CHICAGO Directly NORTH NORTH-WEST and WEST.

ALL RAIL TO THE PACIFIC OCEAN!

Great California Line.

TRAINS LEAVE WELLS STREET DEPOT AS FOLLOWS:

8:30 A. M. Cedar Rapids Pass. 10:15 P. M. Night Mail.
10:45 A. M. Pacific Express. 10:15 P. M. Rock Island Pass.
10:45 A. M. Rock Island Exp. 4:00 P. M. Dixon Passenger.
For Sterling, Rock Island, Fulton, Clinton, Cedar Rapids, Boone, Denison, Missouri Valley Junction, Sioux City, Council Bluffs and Omaha, there connecting with the

UNION PACIFIC R. R.
For Cheyenne, Denver, Ogden, Salt Lake, the White Pine Silver Mines, Sacramento, San Francisco, and all parts of Nebraska, Colorado, New Mexico, Arizona, Wyoming, Montana, Idaho, Utah, Nevada, and the PACIFIC COAST.

FROM CHICAGO Hours. 1st Class Fare. FROM CHICAGO Days. 1st Class Fare.
To OMAHA,..... 23 \$20.00 To SACRAMENTO, 4 1/2 \$118.00
" DENVER,..... 52 70.75 " SAN FRANCISCO, 5 118.00
TRAINS ARRIVE:—Night Mail, 7:00 a. m.; Dixon Passenger, 11:10 a. m.; Pacific Express 4:15 p. m.; Rock Island Express, 4:15 p. m.; Cedar Rapids Passenger, 6:45 p. m.

FREEPORT LINE.

9.00 A. M. & 9.45 P. M. For Belvidere, Rockford, Freeport, Galena, Dun-
4.00 P. M., Rockford Accommodation. loith, and St. Paul.
5.30 P. M., Geneva and Elgin Accommodation
6.10 P. M., Lombard Accommodation.
5.50 P. M., Junction Passenger.

TRAINS ARRIVE:—Freeport Passenger, 2:30 a. m., 3:00 p. m.; Rockford Accommodation, 11:10 a. m.; Geneva and Elgin Accommodation, 8:45 a. m.; Junction Passenger, 8:10 a. m.; Lombard Accommodation, 6:50 a. m.

WISCONSIN DIVISION.

Trains leave Depot, cor. West Water and Kinzie Sts., daily, Sundays excepted, as follows:
10.00 A. M. DAY EXPRESS, for Janesville, Monroe, Whitewater, Madison, Prairie du
Chien, Watertown, Minnesota Junction, Portage City, Sparta, La Crosse, St.
Paul, and ALL POINTS ON THE UPPER MISSISSIPPI RIVER; Ripon, Berlin, Fond du Lac, Oshkosh,
Neenah, Appleton, and Green Bay.

5.00 P. M., Janesville Accommodation.
6.00 P. M. NIGHT EXPRESS, for Madison, Prairie du Chien, Watertown, Minnesota
Junction, Portage City, Sparta, La Crosse, St. Paul, and ALL POINTS ON THE
UPPER MISSISSIPPI RIVER; Ripon, Berlin, Fond du Lac, Oshkosh, Neenah, Appleton, Green Bay,
and THE LAKE SUPERIOR COUNTRY.

5.00 P. M., Woodstock Accommodation.
6:20 P. M., Barrington Passenger.
TRAINS ARRIVE:—5:30 a. m., 7:45 a. m., 10:10 a. m., 1:00 p. m. and 7:15 p. m.

MILWAUKEE DIVISION.

MILWAUKEE MAIL,..... 8:15 A. M.
EXPRESS, (ex. Sun.) Waukegan, Kenosha, Racine and Milwaukee,..... 9:45 A. M.
EVANSTON PASSENGER,..... 1:00 P. M.
HIGHLAND PARK PASSENGER,..... 1:15 P. M.
MILWAUKEE ACCOMMODATION, with Sleeping Car attached,..... 11:00 P. M.
EVANSTON ACCOMMODATION, (Daily,) from Wisconsin Div. Depot,..... 6:15 P. M.
KENOSHA ACCOMMODATION, (Sundays excepted) from Wells St. Depot,..... 4:10 P. M.
AFTERNOON PASSENGER, from Milwaukee Div. Depot,..... 5:45 P. M.
WAUKEGAN ACCOMMODATION, (except Sundays) from Wells St. Depot,..... 5:25 P. M.
WAUKEGAN PASSENGER, (Sundays excepted) from Wells St. Depot,..... 5:00 P. M.
TRAINS ARRIVE:—Night Accommodation, with Sleeping Car, 5:00 a. m.; Day Express, 4:10 p. m.; Milwaukee Mail, 10:10 a. m.; Afternoon Passenger, 8:00 p. m.; Waukegan Accommodation, 8:25 a. m.; Kenosha Accommodation, 9:10 a. m.; Evanston Accommodations, 1:40 and 4:00 p. m.; Waukegan Passenger, 7:55 a. m.; Highland Park Passenger, 3:45 p. m.

PULLMAN PALACE CARS ON ALL NIGHT TRAINS.
THROUGH TICKETS Can be purchased at all principal Railroad Offices East and South, and in Chicago at the Southeast corner of Lake and Clark Streets, and at the Passenger Stations as above.

H. P. STANWOOD,
Gen. Ticket Agt.

GEO. L. DUNLAP,
Gen'l Supt.

Milwaukee & St. Paul R. W.

THE ONLY ALL RAIL LINE TO

ST. PAUL AND MINNEAPOLIS!

AND ALL PORTIONS OF

Wisconsin, Minnesota & Northern Iowa.

PURCHASE TICKETS VIA MILWAUKEE.

Passengers Going via Milwaukee,

Have Choice of Seats in Clean Coaches, and on Night
Trains, a full night's rest in Palace Sleeping Cars.

BAGGAGE CHECKED THROUGH BY THIS ROUTE ONLY!

PASSENGERS FROM CHICAGO can obtain these Advantages only by the MILWAUKEE DIVISION of the CHICAGO & NORTHWESTERN R'Y.

SPECIAL NOTICE.—Passengers destined to any place in Wisconsin, Minnesota, or Northern Iowa, either on or off the Lines of this Company, who cannot procure Through Tickets to their destination, should purchase their Tickets TO MILWAUKEE, as this is the Great Distributing Point for these States.

A. V. H. CARPENTER,
Gen. Pass. Agt. Milwaukee.

S. S. MERRILL,
Gen. Manager, Milwaukee.

CHICAGO, ROCK ISLAND & PACIFIC RAILROAD.

THE DIRECT ROUTE FOR

JOLIET, MORRIS, OTTAWA, LASALLE, PERU, HENRY, PEORIA,
Lacon, Geneseo, Moline,

ROCK ISLAND, DAVENPORT,
Muscatine, Washington, Iowa City,

GRINNELL, NEWTON, DES MOINES,

COUNCIL BLUFFS & OMAHA!

CONNECTING WITH TRAINS ON THE UNION PACIFIC RAILROAD, FOR

Cheyenne, Denver, Central City, Ogden, Salt Lake,
White Pine, Helena, Sacramento, San Francisco,

And Points in Upper and Lower California; and with Ocean Steamers at San Francisco, for all Points in China, Japan, Sandwich Islands, Oregon and Alaska.

TRAINS LEAVE their Splendid new Depot, on VanBuren Street, Chicago, as follows:

PACIFIC EXPRESS, (Sunday excepted)..... 10.00 a. m. 4.15 p. m.
PERU ACCOMMODATION, (Sundays excepted)..... 4.30 p. m. 9.45 a. m.
PACIFIC EXPRESS, (Saturdays excepted,)..... 10.00 p. m. [Mon. ex. 7.00 a. m.]

ELEGANT PALACE SLEEPING COACHES!

Run Through to Peoria and Council Bluffs, Without Change.

Connections at LA SALLE, with Illinois Central Railroad, North and South; at PEORIA, with Peoria, Pekin & Jacksonville Railroad, for Pekin, Virginia, &c.; at PORT BYRON JUNCTION, for Hampton, LeClaire, and Port Byron; at ROCK ISLAND, with Packets North and South on the Mississippi River.

For Through Tickets, and all desired information in regard to Rates, Routes, etc., call at the Company's Offices, No. 37 South Clark Street, Chicago, or 257 Broadway, New York.

A. M. SMITH, Gen. Pass. Agent. HUGH RIDDLE, Gen. Supt. P. A. HALL, Asst. Gen. Supt.

KANSAS PACIFIC RAILWAY.

Great Smoky Hill Route

THROUGH KANSAS TO DENVER, COLORADO,

Connecting with the DENVER PACIFIC R. R. for CHEYENNE; forming, in connection with the UNION and CENTRAL PACIFIC R. R.'s, a NEW ALL-RAIL ROUTE to

Colorado, Wyoming, Utah, Montana,
NEVADA, CALIFORNIA,

AND THE PACIFIC COAST.

THE ONLY ROUTE RUNNING PULLMAN DRAWING-ROOM & SLEEPING CARS THROUGH TO DENVER.

No Omnibus or Ferry Transfer!

Direct Connections made in UNION DEPOTS at Kansas City [State Line.] with the Hannibal & St. Joseph, North Missouri and Missouri Pacific Railroads.

Daily Trains leave Kansas City, State Line and Leavenworth, for Lawrence, Topeka, Emporia, Humboldt, New Chicago, Chetopa, Junction City, Abilene, Salina, Brookville, Ellsworth, Hays, KIT CARSON, DENVER, GREELEY, CHEYENNE, OGDEN, SALT LAKE CITY, CORINNE,

Sacramento & San Francisco.

Connect at Kit Carson with Southern Overland Passenger and Mail Coaches for PUEBLO, TRINIDAD, SANTA FE, and all principal points in

Old and New Mexico and Arizona.

Connect at DENVER with the Colorado Central Railroad and Fast Concord Coaches, for Golden City, Black Hawk, Central City, Idaho City, Georgetown and Fair Play.

Passenger and Freight Rates as low and conveniences as ample as by any Route.

Ask for Tickets via KANSAS PACIFIC RAILWAY, which can be obtained at all principal ticket offices in the United States.

B. B. GEMMELL, Gen. Ticket Agt. T. F. OAKES, Gen. Freight Agt. A. ANDERSON, Gen. Supt.
Lawrence, Kansas. Kansas City, Mo. Lawrence, Kan.

FARMS AND HOMES IN KANSAS.

Five Million Acres of Choice Farming Lands, situated along the line of this Great National Route, at from one to six dollars per acre. For full particulars, apply to JNO. P. DEVEREUX, Land Commissioner, Lawrence, Kan.

THE ERIE & PACIFIC DISPATCH CO.

Are Authorized Freight Agents.

For information, Contracts, and Bills of Lading, apply at their office, 64 Clark Street, Chicago.

H. H. RAPP, AGT.

Western Union Railroad.

CHICAGO & NORTHWESTERN DEPOT, CH AGO. MILWAUKEE & CHICAGO DEPOT, MILWAUKEE.

THE DIRECT ROUTE! CHICAGO, RACINE & MILWAUKEE,

TO

Beloit, Savanna, Clinton, Pt. Byron, Davenport, Mineral Point,
Madison, Freeport, Fulton, Lyons, Rock Island, Sabula,
Galena, Dubuque, Des Moines, Council Bluffs,

OMAHA, SAN FRANCISCO

AND ALL PRINCIPAL POINTS IN

Southern and Central Wisconsin, Northern Illinois, and Central and Northern Iowa.

FRED. WILD,
Gen. Ticket Agent.

D. A. OLIN,
Gen. Superintendent

THE FAVORITE THROUGH PASSENGER ROUTE!

Chicago, Burlington & Quincy RAILROAD LINE.

3 THROUGH EXPRESS TRAINS DAILY!

FROM CHICAGO	Hours	1st Class Fare	FROM CHICAGO	Days	1st Class Fare
TO OMAHA, - - -	23	\$20.00	TO DENVER, - - -	2½	\$63.00
" ST. JOSEPH, - - -	21	19.50	" SACRAMENTO, - - -	4½	118.00
" KANSAS CITY, - - -	22	20.00	" SAN FRANCISCO, - - -	5	118.00

TRAINS LEAVE CHICAGO from the Great Central Depot, foot of Lake Street, as follows:

BURLINGTON, KEOKUK, COUNCIL BLUFFS & OMAHA LINE

7:40 A. M. MAIL AND EXPRESS. (Except Sunday,) stopping at all stations; making close connections at Mendota with Illinois Central for Amboy, Dixon, Freeport, Galena, Dunleith, Dubuque, LaSalle, El Paso, Bloomington, &c.

10:45 A. M. PACIFIC FAST LINE. (Except Sunday,) stopping at Buda, Kewanee, Galva, Galesburg, and all stations West and South of Galesburg.

ELEGANT DAY COACHES and PULLMAN PALACE DRAWING ROOM CARS are attached to this train daily from Chicago

TO COUNCIL BLUFFS & OMAHA WITHOUT CHANGE!

9:00 P. M. PACIFIC NIGHT EXPRESS. (Daily, except Saturday,) for Burlington, Ottumwa, Des Moines, Nebraska City, Council Bluffs, Omaha, and all points West. Pullman Drawing Room Sleeping Car attached to this train daily from Chicago to Burlington, and Elegant Day Coaches, from Chicago to Council Bluffs and Omaha, without change! This is the Route between

CHICAGO, COUNCIL BLUFFS & OMAHA,

—RUNNING THE CELEBRATED—

Pullman Palace Dining Cars!

49 MILES THE SHORTEST ROUTE BETWEEN

Chicago & Keokuk,

And the Only Route Without Ferrying the Mississippi River!

QUINCY, ST. JOSEPH, LEAVENWORTH & KANSAS CITY LINE.

7:40 A. M. MAIL AND EXPRESS (Except Sunday,) stopping at all stations between Chicago and Galesburg; making close connections at Mendota with Illinois Central for Amboy, Dixon, Freeport, Danleith, Dubuque, LaSalle, El Paso, Bloomington, &c.

10:45 A. M. PACIFIC EXPRESS. (Daily, except Sunday,) with ELEGANT DAY COACHES and PULLMAN'S PALACE SLEEPING CARS attached, running through from Chicago to KANSAS CITY, Without Change!

9:00 P. M. PACIFIC NIGHT EXPRESS. (Daily,) with Pullman Palace Drawing Room Sleeping Car attached running through from Chicago to QUINCY.

Kansas City, Lawrence, Topeka and Denver,

WITHOUT CHANGE!

64 MILES THE SHORTEST AND ONLY ROUTE BETWEEN

Chicago and Kansas City!

WITHOUT CHANGE OF CARS OR FERRY.

115 MILES The Shortest Route bet. Chicago & St. Joseph.

THE SHORTEST, BEST AND QUICKEST ROUTE BETWEEN CHICAGO AND

Atchison, Weston, Leavenworth, Lawrence,

AND ALL POINTS ON THE KANSAS PACIFIC R.R.

Local Trains Leave

RIVERSIDE & HINSDALE ACCOMMODATION	7:00 A. M. 1:30 & 6:15 P. M.
GALESBURG PASSENGER	3:00 P. M.
MENDOTA PASSENGER	4:15 P. M.
AURORA PASSENGER	5:30 P. M.

Ask for Tickets via Chicago, Burlington & Quincy Railroad, which can be obtained at all principal offices of connecting roads, at Company's office, 63 Clark Street, and at Great Central Depot, Chicago at as low rates as by any other route.

ROBT HARRIS,
Gen'l Superintendent,
CHICAGO.

SAM'L POWELL,
Gen'l Ticket Agent,
CHICAGO.

E. A. PARKER,
Gen. West. Pass. Agt.,
CHICAGO.

THE GREAT THROUGH PASSENGER ROUTE TO KANSAS

IS VIA THE OLD RELIABLE

HANNIBAL & ST. JOSEPH SHORT LINE.

Crossing the Mississippi at Quincy and the Missouri at Kansas City on New Iron Bridges; running Three Daily Express Trains, Through Cars and Pullman Sleeping Palaces from Chicago & Quincy to St. Joseph & Kansas City.

The Advantages gained by this Line over any other Route from Chicago, are:

115 MILES THE SHORTEST!

To St. Joseph, Atchison, Hiawatha, Waterville, Weston, Leavenworth,

64 MILES THE SHORTEST!

To Kansas City, Fort Scott, Lawrence, Ottawa,

Garnett, Iola, Humboldt, Topeka, Burlingame, Emporia, Manhattan, Fort Riley, Junction City, Salina, Ellsworth, Hays, Sheridan, Olathe, Paola, Cherokee Central Lands, Baxter Springs, Santa Fe, New Mexico, and all points on the KANSAS PACIFIC, and MISSOURI RIVER, FT. SCOTT & GULF R. R.'s, with which we connect at Kansas City Union Depot.

THIS BEING THE SHORTEST LINE AND QUICKEST, is consequently the cheapest; and no one that is posted thinks of taking any other Route from Chicago to reach principal points in

Missouri, Kansas, Indian Territory, or New Mexico.

DAILY OVERLAND STAGES from west end Kansas Pacific Railway, for Pueblo, Santa Fe, Denver, and points in Colorado and New Mexico.

This is also a most desirable Route, via St. Joseph, to Brownsville, Nebraska City, Council Bluffs, and Omaha, connecting with the Union Pacific Railroad for Cheyenne, Denver, Salt Lake, Sacramento, San Francisco, and the Pacific coast.

Through Tickets for Sale at all Ticket Offices. Baggage Checked Through, and Omnibus Transfers and Portage avoided.

P. B. GROAT, Gen. Ticket Agent.

HANNIBAL, MO.

GEO. H. NETTLETON, Gen. Supt.

HANNIBAL, MO.

Old, Reliable, Air-Line Route!

CHICAGO, ALTON & ST. LOUIS R. R.

SHORTEST, QUICKEST AND ONLY DIRECT ROAD TO

Bloomington, Springfield, Jacksonville, Alton

— AND —

ST. LOUIS!

WITHOUT CHANGE OF CARS.

THE ONLY ROAD MAKING IMMEDIATE CONNECTIONS AT ST. LOUIS WITH MORNING AND EVENING TRAINS

— FOR —

ATCHISON, LEAVENWORTH, KANSAS CITY.

Lawrence, Topeka, Memphis, New Orleans,

And All Points South and Southwest.

TRAINS leave CHICAGO from the West-side Union Depot, near Madison Street Bridge.

	Depart.	Arrive.
EXPRESS MAIL	*9:15 A. M.	*8:05 P. M.
JOLIET ACCOMMODATION	*4:00 P. M.	*9:40 A. M.
NIGHT EXPRESS	*5:30 "	*12:50 P. M.
LIGHTNING EXPRESS	*9:00 "	*7:30 A. M.

*Sundays excepted.

†Daily; Saturdays it runs to Bloomington only.

‡Saturdays and Sundays excepted. Monday mornings this train runs from Bloomington to St. Louis.

This is the ONLY LINE Between CHICAGO & ST. LOUIS RUNNING

Pullman's Palace Sleeping and Celebrated Dining Cars!

BAGGAGE CHECKED THROUGH.

Through Tickets can be had at the Company's office, No. 55 Dearborn street, Chicago, or at the Depot, corner of West Madison and Canal streets, and at all principal Ticket Offices in the United States and Canada. Rates of Fare and Freights as low as by any other Route.

A. NEWMAN, Gen. Pass. Agent.

J. C. McMULLIN, Gen. Supt.

North Missouri R. R.

PASSENGERS FOR

KANSAS AND THE WEST,

ARE REMINDED THAT

THE NORTH MISSOURI R. R.

— IS —

11 MILES SHORTER than any other Route!

BETWEEN

St. Louis and Kansas City.

15 Miles Shorter between ST. LOUIS and LEAVENWORTH

— AND —

50 MILES SHORTER TO ST. JOSEPH!

THAN ANY OTHER LINE OUT OF ST. LOUIS.

Three Through Express Trains Daily!

Pullman's Celebrated Palace Sleeping Cars on all Night Trains!

FOR TICKETS, apply at all Railroad Ticket Offices, and see that you get your Tickets via St. Louis and North Missouri Railroad.

JAMES CHARLTON,

Gen. Pass. and Ticket Agent, St. Louis.

W. R. ARTHUR,

General Superintendent, St. Louis.

Pacific Railroad of Missouri.

THE MOST DIRECT AND RELIABLE ROUTE FROM ST. LOUIS THROUGH TO

KANSAS CITY, LEAVENWORTH & ATCHISON,

WITHOUT CHANGE OF CARS!

Close Connections at KANSAS CITY with Missouri Valley, Missouri River, Ft. Scott & Gulf, and Kansas Pacific R'y's, for Weston, St. Joseph, Junction City, Fort Scott, Lawrence, Topeka, Sheridan, Denver, Fort Union, Santa Fe, and

ALL POINTS WEST!

At SEDALIA, WARRENSBURG and PLEASANT HILL, with Stage Lines for Warsaw, Quincy, Bolivar, Springfield, Clinton, Osceola, Lamar, Carthage, Granby, Neosho, Baxter Springs, Fort Gibson, Fort Smith, Van Buren, Fayetteville, Bentonville.

PALACE SLEEPING CARS on all NIGHT TRAINS.
Baggage Checked Through Free!

THROUGH TICKETS for sale at all the Principal Railroad Offices in the United States and Canada. Be Sure and Get your Tickets over the PACIFIC R. R. OF MISSOURI.

W. B. HALE,

Gen. Pass. and Ticket Agt.

THOS. MCKISOCK,

General Superintendent

61 Miles the Shortest Line! — FROM — CHICAGO TO NEW YORK.

Pitts., Ft. Wayne & Chicago

PENNSYLVANIA CENTRAL

IS THE ONLY ROUTE

Running its Entire Trains THROUGH to Philadelphia and New York, and the only Route running Three Daily Lines of Pullman Day and Sleeping Palaces, from Chicago to

PITTSBURGH, HARRISBURG, PHILADELPHIA & NEW YORK,

WITHOUT CHANGE!

WITH BUT ONE CHANGE TO

BALTIMORE, PROVIDENCE, NEW HAVEN, HARTFORD, SPRINGFIELD, WORCESTER & BOSTON!

AND THE MOST DIRECT ROUTE TO WASHINGTON.

Trains Leave WEST SIDE UNION DEPOT, corner West Madison and Canal Streets, as follows:

	Mail.	Fast Express.	Pacific Exp.	Night Exp.
Leave—CHICAGO.....	5.30 A. M.	9.00 A. M.	5.15 P. M.	9.00 P. M.
Arrive—PLYMOUTH.....	9.50 "	12.03 P. M.	8.45 "	12.35 A. M.
" FORT WAYNE.....	12.30 P. M.	2.05 "	11.15 "	3.10 "
" LIMA.....	3.24 "	4.06 "	1.23 A. M.	5.40 "
" FOREST.....	4.43 "	5.06 "	2.45 "	7.07 "
" CRESTLINE.....	6.20 "	6.30 "	4.20 "	8.55 "
Leave—CRESTLINE.....	6.00 A. M.	6.50 "	4.30 "	9.35 "
Arrive—MANSFIELD.....	6.40 "	7.17 "	5.00 "	10.05 "
" ORRVILLE.....	9.15 "	9.05 "	6.54 "	11.55 "
" ALLIANCE.....	11.10 "	10.40 "	8.30 "	1.30 P. M.
" PITTSBURGH.....	3.45 P. M.	1.55 A. M.	12.10 P. M.	4.40 "
" CRESSON.....	11.57 "	5.44 "	4.45 "	10.00 "
" ALTOONA.....	12.48 A. M.	6.55 "	5.55 "	2.40 A. M.
" HARRISBURG.....	5.50 "	11.25 "	10.45 "	2.50 "
" PHILADELPHIA.....	6.50 "	3.15 "	3.00 "	6.50 "
" NEW YORK, VIA PHILADELPHIA.....	10.30 "	6.30 "	6.41 "	10.30 "
" NEW YORK, VIA ALLENTOWN.....	10.30 "	6.30 "	6.41 "	10.30 "
" BALTIMORE.....	9.15 P. M.	3.05 "	2.30 A. M.	9.15 P. M.
" WASHINGTON.....	1.00 "	5.15 "	5.45 "	1.00 "
" BOSTON.....	9.00 "	5.50 A. M.	6.00 "	9.00 "

Boston and New England Passengers will find this Route especially Desirable, as it gives them an opportunity of Seeing the FINEST VIEWS AMONG THE ALLEGHANY MOUNTAINS,

Besides Visiting PITTSBURGH, PHILADELPHIA and NEW YORK, without extra cost!

All New England Passengers holding Through Tickets will be Transferred, with their Baggage, to Rail and Boat Connections in NEW YORK, Without Charge!

THROUGH TICKETS for sale at the Company's Offices, at 65 Clark St.; 52 Clark St.; cor. Randolph and LaSalle Sts.; and at Depot, Chicago. Also at Principal Ticket Offices in the West.

CLOSE CONNECTIONS Made at LIMA for all Points on the Dayton & Michigan and the Cincinnati, Hamilton & Dayton Railways, and at CRESTLINE for Cleveland and Columbus.

Express Trains are Equipped with WESTINGHOUSE AIR BRAKES, The Most Perfect Protection Against Accidents in the World!

F. R. MYERS, W. C. CLELAND, Gen. Pass. & Tkt. Agt. P. F. W. & C. R'y Chicago. | Gen. Western Pass. Agt. P. F. W. & C. R'y, Chicago.
T. L. KIMBALL, Gen. Western Pass. Agt. Penn. Cen. R. R. Chicago.

Broad Gauge! Double Track! ERIE RAILWAY.

4 EXPRESS TRAINS DAILY!
From Cleveland, Dunkirk and Buffalo, 625 Miles, to New York, WITHOUT CHANGE of Coaches!

The Trains of this Railway are run in DIRECT CONNECTION WITH ALL WESTERN AND SOUTHERN LINES, for

Elmira, Williamsport, Oswego, Great Bend, Scranton, Newburgh,
NEW YORK, ALBANY, BOSTON, PROVIDENCE,
AND PRINCIPAL NEW ENGLAND CITIES.

New and Improved DRAWING ROOM COACHES are attached to the DAY EXPRESS Running THROUGH TO NEW YORK.

SLEEPING COACHES, Combining all Modern Improvements, with perfect Ventilation and the peculiar arrangements for the comfort of Passengers incident to the BROAD GAUGE, accompany all night trains to New York.

CONNECTIONS CERTAIN! as Trains on this Railway will, when necessary, wait from one to two hours for Western trains.

All Trains of Saturday run directly Through to New York.

Ask for Tickets via Erie Railway, which can be procured at 66 Clark Street, Chicago, and at all Principal Ticket offices in the West and Southwest.

L. D. RUCKER, A. J. DAY, WM. R. BARR, Gen'l Superintendent, New York. | Western Passenger Agent, Chicago. | Gen'l Passenger Agent, New York.

Pan-Handle — AND — Penn'a Central Route East!

SHORTEST AND QUICKEST ROUTE, VIA COLUMBUS, TO
PITTSBURGH, BALTIMORE, PHILADELPHIA & NEW YORK

On and after Sunday, NOVEMBER 30th, 1870, Trains for the East will run as follows:
[DEPOT CORNER CANAL AND KINKIE STS., WEST SIDE.]

7:40 A. M. DAY EXPRESS.
[SUNDAYS EXCEPTED.] Via Richmond. Arriving at

COLUMBUS... 3:00 A. M. | HARRISBURG... 10:35 P. M. | NEW YORK... 6:40 A. M. | WASHINGTON... 5:45 A. M.
PITTSBURGH... 12:15 M. | PHILADELPHIA 3:10 A. M. | BALTIMORE... 3:30 A. M. | BOSTON... 5:05 P. M.

7:10 P. M. NIGHT EXPRESS.
[SUNDAYS EXCEPTED.] Arriving at:

COLUMBUS... 11:15 A. M. | HARRISBURG... 5:30 A. M. | NEW YORK... 11:40 A. M. | WASHINGTON... 1:10 P. M.
PITTSBURGH... 7:25 P. M. | PHILADELPHIA 9:50 A. M. | BALTIMORE... 9:30 A. M. | BOSTON... 11:50 P. M.

Palace Day and Sleeping Cars

Run Through to COLUMBUS, and from Columbus to NEW YORK, WITHOUT CHANGE!

ONLY ONE CHANGE TO NEW YORK, PHILADELPHIA, OR BALTIMORE!

CINCINNATI & LOUISVILLE AIR LINE SOUTH.

35 Miles the Shortest Route to Cincinnati.
18 Miles the Shortest Route to Indianapolis and Louisville.

3 Hours the Quickest Route to Cincinnati!

THE SHORTEST AND BEST ROUTE TO

Columbus, Chillicothe, Hamilton, Wheeling, Parkersburg, Evansville, Dayton, Zanesville, Marietta, Lexington, Terre Haute, Nashville,

ALL POINTS IN CENTRAL & SOUTHERN OHIO, & INDIANA, KENTUCKY & VIRGINIA.

— QUICK, DIRECT AND ONLY ALL RAIL ROUTE TO —

New Orleans, Memphis, Mobile, Vicksburg, Charleston, Savannah,
AND ALL POINTS SOUTH.

Cincinnati, Indianapolis and Louisville Trains run as follows:

THROUGH WITHOUT CHANGE OF CARS!

7.40 A. M.	8.05 P. M.
(Sundays excepted) Arriving at	(Saturdays excepted.) Arriving at
LOGANSPORT..... 1:15 P. M.	LOGANSPORT..... 1:15 A. M.
KOKOMO..... 2:33 P. M.	KOKOMO..... 3:31 A. M.
CINCINNATI..... 10:10 P. M.	CINCINNATI..... 9:35 A. M.
INDIANAPOLIS..... 5:00 P. M.	INDIANAPOLIS..... 5:40 A. M.
LOUISVILLE..... 11:30 P. M.	LOUISVILLE..... 3:50 P. M.

Lansing Accommodation: Leaves 3:40 P. M. Arrives 10:55 A. M.

PULLMAN'S PALACE SLEEPING CARS!

Accompany all Night Trains between Chicago and Cincinnati or Indianapolis.

Ask for Tickets via COLUMBUS for the East, and via "The AIR LINE" for Cincinnati, Indianapolis, Louisville and points South. Tickets for sale and Sleeping Car Berths secured at 95 RANDOLPH STREET, CHICAGO, and at Principal Ticket Offices in the West and Northwest.

WM. L. O'BRIEN,

Gen. Pass. and Ticket Agent, Columbus.

I. S. HODSDON

Northwestern Pass. Agt. Chicago.

D. W. CALDWELL Gen. Supt. Columbus.

The Great Favorite Route for Missouri, Nebraska and Iowa.

KANSAS CITY, ST. JOSEPH

— AND —

COUNCIL BLUFFS

THROUGH LINE!

3 EXPRESS PASSENGER TRAINS Leave Union Depot Daily, on the arrival of Eastern Southern and Western Trains, crossing the Missouri River on the New Iron Bridge at KANSAS CITY, passing the cities of

LEAVENWORTH, ATCHISON, SAINT JOSEPH,

— AND —

NEBRASKA CITY.

Connecting at COUNCIL BLUFFS with Iowa Lines for all prominent points in Iowa, and making DIRECT CONNECTION at OMAHA with the Great Union Pacific Railroad, for

CHEYENNE, DENVER, SALT LAKE, SACRAMENTO, SAN FRANCISCO
And the Pacific Coast.

Pullman's Palace Sleeping Cars!

ON ALL NIGHT TRAINS.

Ask for Tickets via the People's Favorite Route, Kansas City, St. Joseph & Council Bluffs Railroad Line.

A. L. HOPKINS,

Gen. Superintendent, ST. JOSEPH, Mo.

A. C. DAWES,

Gen. Passenger Agent, ST. JOSEPH, Mo.

LAKE SHORE — AND — MICHIGAN SOUTHERN R.W.

THE GREAT THROUGH LINE BETWEEN
CHICAGO, BUFFALO & NEW YORK,
WITHOUT CHANGE!

AND THE ONLY RAILWAY
RUNNING PALACE COACHES THROUGH!

— BETWEEN —
CHICAGO & NEW YORK, via BUFFALO
WITHOUT TRANSFER OF PASSENGERS!

All Trains Stop at Twenty-Second Street to Take and Leave Passengers.
Baggage Checked at that Station for all Points East.

4 EXPRESS TRAINS DAILY, [Sundays Excepted,] Leave
Chicago from the New Depot, on Van Buren St., at the head of L. a Salle Street, as follow

5:30 A. M. MAIL TRAIN.
VIA OLD ROAD AND AIR LINE. SUNDAYS EXCEPTED.

Leaves 23d Street 7:45 A. M. Stops at all Stations. Arrives—Cleveland, 9:35 P. M.

9:00 A. M. SPECIAL NEW YORK EXPRESS,
VIA AIR LINE. SUNDAYS EXCEPTED.

Leaves—Twenty-Second Street, 9:15 A. M. Arrives—Elkhart, 12:45 P. M.; Cleveland 9:45 P. M.; Buffalo, 4:10 A. M.; New York, 7:00 P. M.; (Chicago Time) Boston, 11:45 P. M.

This Train has **PALACE SLEEPING COACH** Attached, Running
THROUGH TO ROCHESTER, WITHOUT CHANGE!

IN DIRECT CONNECTION WITH

Wagner's Celebrated Drawing-Room Coaches on N. Y. Central R. R.
Only Thirty-Three Hours, Chicago to New York!

5:15 P. M. ATLANTIC EXPRESS (Daily),
VIA OLD ROAD.

Leaves—Twenty-Second Street 5:30 P. M. Arrives—Laporte, 8:10 P. M. (Stops 20 minutes or Supper); arrives at Toledo, 2:50 A. M.; Cleveland, 7:25 A. M. (30 minutes for Breakfast); arrives at Buffalo, 1:50 P. M.; Rochester, 5:10 P. M. (30 minutes for Supper); connects with **Sleeping Coach** running Through from Rochester to Boston Without Change, making but One Change between Chicago and Boston.

NEW AND ELEGANT SLEEPING COACH Attached to this Train, Running
THROUGH from CHICAGO TO NEW YORK WITHOUT CHANGE! Arrives
at NEW YORK, 7:15 A. M.

9:00 P. M. NIGHT EXPRESS
VIA AIR LINE. (DAILY EXCEPT SAT. & SUN.)

Leaves—Twenty-Second Street, 9:15 P. M. Arrives—Toledo, 6:15 A. M. (30 minutes for Breakfast); arrives at Cleveland, 10:40 A. M.; Buffalo, 5:50 P. M.; New York, 12:00 M.; Boston, 8:50 P. M.

KALAMAZOO DIVISION.

Leave Chicago 9:00 A. M. Arrive at Kalamazoo 4:10 P. M.;
Grand Rapids, 7:10 P. M.

Leave Chicago 9:00 P. M. Arrive at Kalamazoo 7:25 A. M.;
Grand Rapids, 10:15 A. M.

There being no heavy grades to overcome, or mountains to cross, the road bed
and track being the smoothest and most perfect of any railway in the United States, this Company run
their trains at a high rate of speed with perfect safety.

Travelers who wish to **SAVE TIME** and make **SURE CONNECTIONS**,
purchase Tickets via

LAKE SHORE & MICHIGAN SOUTHERN R'Y.

THE ONLY LINE RUNNING THROUGH BETWEEN CHICAGO AND
BUFFALO, WITHOUT TRANSFER, and in Direct Connection with NEW YORK
CENTRAL RAILROAD and ERIE RAILWAY.

General Ticket Office for Chicago, No. 56 Clark Street.

CHAS. F. HATCH,
General Superintendent, CLEVELAND, OHIO

F. E. MORSE,
General Western Passenger Agent, CHICAGO.

ILLINOIS CENTRAL RAILROAD.

PASSENGER TRAINS LEAVE CHICAGO FROM THE GREAT CENTRAL DEPOT, FOOT OF LAKE ST.

ST. LOUIS AND CHICAGO THROUGH LINE.

No Change of Cars from Chicago to St. Louis.

9:20 A. M. DAY EXPRESS Sundays Ex.
Arriving in ST. LOUIS at 10:30 P. M.

8:15 P. M. FAST LINE. Saturdays Excepted.
Arriving at ST. LOUIS at 8:00 A. M.

AT ST. LOUIS, Direct Connections are Made FOR

Jefferson City, Sedalia, Pleasant Hill, Macon, Kansas City,
LEAVENWORTH, ST. JOSEPH & ATCHISON,

—Connecting at KANSAS CITY for—

LAWRENCE, TOPEKA, JUNCTION CITY, SALINA, SHERIDAN,

Denver and San Francisco!

CAIRO, MEMPHIS AND NEW ORLEANS LINE.

No Change of Cars from Chicago to Cairo.

9:20 A. M. CAIRO MAIL, Sundays Excepted.
Arriving at Cairo 2:05 A. M., Memphis 12:45 P. M., Mobile 9:25 A. M.,
Vicksburg 9:25 A. M., New Orleans 11:05 A. M.

8:15 P. M. CAIRO EXPRESS, Except Saturdays.
Arriving at Cairo 12:34 P. M., Memphis 4:15 A. M., Little Rock 7:00
P. M., Vicksburg 8:10 P. M., New Orleans 1:30 A. M.

4:50 P. M. CHAMPAIGN PASSENGER,
Arriving at Champaign at 10:45 P. M.

THIS IS THE ONLY DIRECT ROUTE TO

Humboldt, Corinth, Grand Junction, Little Rock, Hot Springs,
Selma, Canton, Grenada, Columbus, Meridian, Enterprise,

MEMPHIS, VICKSBURG, NEW ORLEANS & MOBILE.

At NEW ORLEANS, connections are made for

GALVESTON, INDIANOLA,

And all Parts of Texas.

NOTICE.—This Route is from 100 to 150 MILES SHORTER, and from
12 to 24 HOURS QUICKER than any other.

THIS IS ALSO THE ONLY DIRECT ROUTE TO

DECATUR, TERRE HAUTE, VINCENNES & EVANSVILLE.

Peoria and Keokuk Line.

9:20 A. M. KEOKUK PASSENGER, Sun. Excepted.
Arriving at Chenoa 2:30 P. M., El Paso 4:08 P. M., Peoria 5:49 P. M.,
Canton 7:15 P. M., Bushnell 8:57 P. M., Keokuk 11:15 P. M., Warsaw 11:40 A. M.

Elegant Drawing Room Sleeping Cars

ATTACHED TO ALL NIGHT TRAINS.

Spacious and Fine Saloon Cars!

WITH ALL MODERN IMPROVEMENTS, RUN UPON ALL TRAINS.

BAGGAGE CHECKED THROUGH TO ALL IMPORTANT POINTS.

For Through Tickets, Sleeping Car Berths, Baggage Checks, and information, apply at the office
of the Company in the Great Central Depot, foot of Lake St.

Hyde Park and Oakwoods Train.

HYDE PARK TRAIN...	LEAVE *6:30 A. M.	ARRIVE *7:45 A. M.	HYDE PARK TRAIN...	LEAVE *3:00 P. M.	ARRIVE *5:15 P. M.
HYDE PARK TRAIN...	*8:00 A. M.	*9:30 A. M.	HYDE PARK TRAIN...	*8:10 P. M.	*9:35 P. M.
HYDE PARK TRAIN...	*12:10 P. M.	*1:45 P. M.			

* Sundays Excepted.

W. P. JOHNSON, Gen. Pass. Agent.

M. HUGHITT, Gen. Supt.

1870. Great Central Route! 1870.

SPEED! COMFORT! SAFETY!

MICHIGAN CENTRAL and GREAT WESTERN RAILWAYS!

The Great Central Route, via Niagara Falls, to

NEW YORK AND NEW ENGLAND.

Pullman's Magnificent Palace Drawing-Room Cars,

— FROM —

CHICAGO TO NEW YORK CITY, WITHOUT CHANGE.

4 PASSENGER TRAINS LEAVE CHICAGO, DAILY EXCEPT SUNDAY.

(DEPOT, FOOT OF LAKE STREET,) as follows:

5:40 A. M. MAIL TRAIN. Stops at all Stations.

(SUNDAYS EXCEPTED.)

Arrives DETROIT at 6:30 P. M.

9:00 A. M. SPECIAL NEW YORK & BOSTON EXP.

(SUNDAYS EXCEPTED.)

Arrives at Michigan City 11:10 A. M.; Niles 12:40, (Dinner), Kalamazoo 2:15 P. M.; Battle Creek 3:00, Marshall 3:24, Jackson 4:30, Detroit 6:55; London 12:05 A. M.; Hamilton 2:35 A. M.; Toronto 10:00, Suspension Bridge 4:40, Rochester 7:15 A. M.; Albany, 2:25 P. M.; NEW YORK, 7:00, BOSTON, 11:45 P. M. This train connects at ROCHESTER (7:15 A. M.) with

Wagner's Magnificent Palace Drawing-Room Cars!

RUNNING THROUGH TO NEW YORK, WITHOUT CHANGE!

5:15 P. M. ATLANTIC EXPRESS.

(DAILY.)

Arrives at Michigan City, 7:23 P. M.; Niles 8:51 P. M. (Supper); Kalamazoo, 10:30 P. M.; Jackson, 1:05 A. M.; Detroit 3:45, London, 8:35, (Breakfast); Hamilton 11:40, Suspension Bridge 2:35 P. M.; Rochester 5:10 P. M.; Albany, 1:50 A. M.; NEW YORK, 7:15 A. M.; BOSTON, 11:00 A. M. A MAGNIFICENT DRAWING-ROOM SLEEPING CAR is attached to this train daily, FROM CHICAGO TO NEW YORK CITY. The celebrated

Hotel Drawing-Room Car is also attached to this Train from Chicago to Rochester!

These, together with ELEGANT DAY CARS TO SUSPENSION BRIDGE, make this Train the favorite Train for all points East.

SPECIAL NOTICE.—Boston and New England Passengers will please notice that this Train now makes direct connection through. A SLEEPING CAR is attached at Rochester at 5:20 P. M., running through to Springfield, Mass., thus avoiding transfer at Albany. Breakfast at Springfield. This Train reaches Springfield early enough second morning to Connect with all Trains up and down the Connecticut.

9:00 P. M. NIGHT EXPRESS.

(SAT. & SUN. EXCEPTED.)

Arrives at Michigan City, 11:10 P. M.; Niles, 12:38 A. M.; Kalamazoo, 2:10; Marshall, 3:25; Jackson, 4:45; Grand Trunk Junction, 7:30; Detroit, 7:45; London, 1:45 P. M.; Hamilton, 4:35; Toronto, 9:35; Niagara Falls, 8:25; Buffalo, 7:15 P. M.; Rochester, 9:05; Syracuse, 12:35 A. M.; Rome, 1:55; Utica, 2:25; Albany, 6:30 A. M.; NEW YORK, 12:00 M.; BOSTON, 3:50 P. M.

PULLMAN'S PALACE SLEEPING CARS ARE ATTACHED TO THIS TRAIN FROM CHICAGO TO DETROIT,

And from Suspension Bridge to New York.

WE INVITE THE ATTENTION OF THE TRAVELER to the SPLENDID EQUIPMENTS of this FIRST-CLASS LINE TO THE EAST!

FOR THROUGH TICKETS, and any and all information, Sleeping Car accommodations, &c., apply at General Office in Tremont House Block, at office in Great Central Depot; also at No. 60 Clark street, under Sherman House; at Grand Trunk Railway Office, 45 Clark street, or at New York Central Railroad Office, No. 53 Clark street, and at office under Briggs House.

H. E. SARGENT, Gen. Supt. M. C. R. R.

W. K. MUIR, Gen. Supt. Gt. Western R. W.

HENRY C. WENTWORTH, Gen. Pass. Agt.

CHICAGO, INDIANAPOLIS & LOUISVILLE

THROUGH LINE!

— VIA —

MICHIGAN CENTRAL RAILROAD.

THE ONLY ROUTE TO

TO LOUISVILLE, WITHOUT CHANGE OF CARS.

TWO EXPRESS TRAINS Leave Chicago Depot, Foot of Lake as follows:

9:00 A. M. MORNING EXPRESS

(EXCEPT SUNDAY.)

Arriving at LaFayette, 2:25 P. M.; Indianapolis, 6:00 P. M.; Louisville, 11:30 P. M.

4:30 P. M. AFTERNOON EXPRESS

(EXCEPT SATURDAY.)

Arriving at Michigan City 6:30 P. M. (Supper); LaFayette, 11:30 P. M.; Indianapolis, 2:15 A. M.; Louisville, 7:00 A. M.; Nashville, 4:00 P. M.

A GOOD SLEEPING CAR is Attached to this Train Every Night,

And goes from Chicago to Louisville WITHOUT CHANGE!

SPECIAL NOTICE.—This Train stops at Michigan City for Supper, and waits at that point for Michigan Central Atlantic Express East, leaving Chicago at 4:45 p. m. Passengers going South, and wishing as much time in Chicago as possible, can take the 4:45 p. m. Michigan Central Atlantic Express, and connect without fail at Michigan City, with above Through Louisville Express.

THE GREAT BRIDGE ACROSS THE OHIO at Louisville being completed, passengers are relieved of the omnibus transfer.

FOR THROUGH TICKETS, via this line, apply at offices of connecting lines and at all Ticket offices in Chicago.

HENRY C. WENTWORTH, Gen. Pass. Agent.

Michigan Central R. R.

LOCAL CONNECTIONS:

Chicago & Michigan Lake Shore Railroad.

Open from New Buffalo to St. Joseph, Mich.

5:00 A. M. AND 4:30 P. M. Trains from Chicago Connect at New Buffalo.

Kalamazoo, Allegan & Grand Rapids R. R.

Open to Grand Rapids.

11:30 A. M. AND 9:00 P. M. Trains from Chicago Connect at Kalamazoo

Peninsular Railroad of Michigan.

Open to Charlotte.

5:00 A. M. AND 9:00 P. M. Trains from Chicago Connect at Battle Creek.

Jackson, Lansing & Saginaw Railroad.

Open to Bay City, Mich. Passing through Lansing and Saginaw.

5:00 A. M. AND 9:00 P. M. Trains from Chicago Connect at Jackson.

GRAND TRUNK RAILWAY.

All Michigan Central Trains Connect at Grand Trunk Junction

— FOR —

SARNIA, TORONTO, MONTREAL,

PORTLAND, BOSTON, BUFFALO, OGDENSBURG

AND ALL POINTS EAST.

H. E. SARGENT, General Superintendent.

JACOB R. SHEPHERD & CO.,

155 and 157 LaSalle Street,
CHICAGO.

RAILWAY BANKERS

NEGOTIATE

MORTGAGE BONDS,

And Local Bonds issued in Aid;

Make Advances; Complete Unfinished
Roads, etc., etc.**BLISS, TILLOTSON & CO.,**

Manufacturers and Dealers in

TELEGRAPH MACHINERY,

—AND—

SUPPLIES

Of Every Description.

247 South Water Street,

CHICAGO, ILL.

L. S. TILLOTSON & CO., N. Y. / G. H. BLISS, CHICAGO.

Established 1852.

CLEVELAND FILE WORKS

CLEVELAND, OHIO.

All descriptions of Files Manufactured and Re-cut. Also, dealers in *Best English Cast Tool Steel*. Orders solicited and satisfaction guaranteed.

JOHN PARKIN, Prop'r.**GIRARD****TUBE WORKS & IRON COMPANY.**

PHILADELPHIA, PA.

Manufacture Plain and Galvanized **WROUGHT IRON PIPE** and Sundries for Gas and Steam Fitters, Plumbers, Machinists, Railing Makers, Oil Refiners, &c.
Works—Twenty-Third and Filbert Streets.
OFFICE AND WAREHOUSE—No. 43 N. Fifth St.

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Should Address Orders for

THE RAILROAD GAZETTE,

— TO —

The Western News Company,

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IMPORTANT DISCOVERY!**"A COPYING PRINTERS' INK,"**

[McILVAINE'S PATENT.]

Peculiarly adapted for

Manifests, Bills of Lading, Bank Circulars, Reports and Statements of Accounts Current, Letter Heads, &c.

Yielding as PERFECT AN IMPRESSION as that of the BEST COPYING INK for writing purposes—the use of the two in connection filling a want never heretofore supplied.

HELFENSTEIN & LEWIS,

Railroad and Commercial Printing Rooms.

Corner of Fifth and Chestnut Streets,

PHILADELPHIA.

Specimen Impressions furnished on application.

BENOIT & WOOD,

Manufacturers and Importers of

Artists' Materials!

Drawing Paper, Mathematical Instruments, Architects' and Engineers' Supplies, Patented T Squares, Triangles and Straight Edges.
148 FULTON STREET, NEW YORK.

**HARRISBURG
CAR MANUFACTURING CO.,**

Harrisburg, Pennsylvania,

MANUFACTURE

Passenger, Mail,**Baggage, Box****Gondola, Coal,**

AND ALL OTHER KINDS OF

RAILROAD CARS!

Railroad Car Wheels & Castings,

Bridge & Rolling Mill Castings,

Bridge Rods, Bolts,

—AND—

RAILROAD FORGINGS!

W. T. HILDRUP, Superintendent.

WILLIAM COLDER, President.

HARRISBURG**Foundry and Machine Works!**

(Branch of Harrisburg Car Mfg Co.,)

Harrisburg, - - Pennsylvania.

MANUFACTURERS OF

MACHINISTS' TOOLS!

— SUCH AS —

LATHES, PLANERS,**Shaping and Slotting Machines,****Bolt Cutting & Nut Tapping Machines, &c.**

W. T. HILDRUP, Treasurer.

PHOENIXVILLE BRIDGE WORKS.**Clarke, Reeves & Co.,**

Successors to Kellogg, Clarke & Co.,

Engineers & Iron Bridge Builders,

OF PHOENIXVILLE, PA.,

Will henceforth have their Principal Business Office at 410 Walnut St., Philadelphia, to which all correspondence should be addressed. Circulars, plans and prices sent on application.

IRON BRIDGES, PIVOT BRIDGES

—AND—

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